Are You Ready!

Contents, June, 1918

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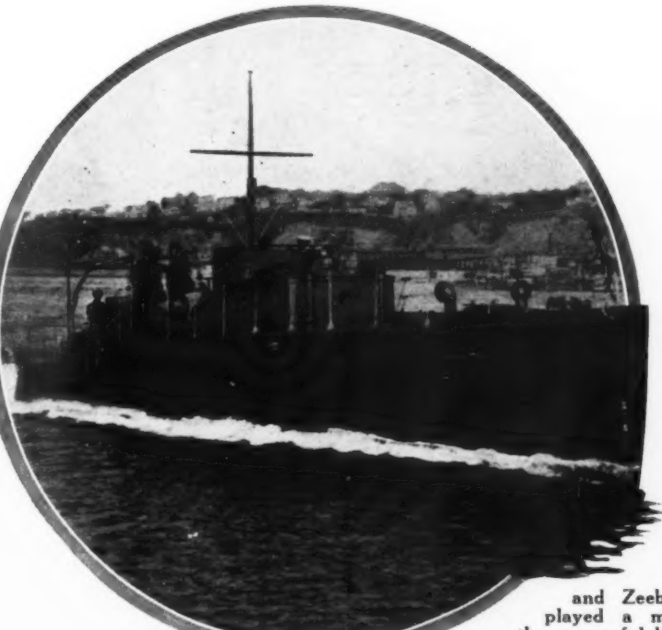
MOTOR BOATING



One of the 550 Elco-built British motor patrol boats, a number of which participated in the recent raids upon the German U-boat bases at Ostend and Zeebrugge. These boats played a most important part in the successful blocking of the entrances to the harbors

Motor Boats Hunt the Huns

By T. W. Rockwell

MOTOR BOATS have time and again proved their worth as submarine chasers and for patrol service, but it was not until the recent attacks on Zeebrugge and at Ostend that they had an opportunity to prove how valuable an auxiliary they are in an action with the larger ships. Heretofore it has been a case of submarine vs. motor boat, with the motor boat generally the winner.

As the fleet of cruisers, destroyers and motor boats approached the Belgian coast in the early morning hours of April 23, a smoke cloud or artificial fog was spread over the water in advance of them by motor boats and destroyers equipped with apparatus especially built for the purpose. For this work the motor boat is superior to the destroyer; they do not require as great a depth of water to operate in, enabling them to run close in shore; the number of men required to accomplish the same result is much smaller, and a motor boat spreads as big a smoke screen as a battleship.

When the smoke screen had blown in over the mole and the entrance to the harbor, two motor boats took their stations at the outer end of the channel with flares to act as guides for the cruisers, concrete-filled vessels, and destroyers.

Operating under the cover of the smoke, and aided by the cloudy weather and rain, the approach of the fleet was unknown to the enemy until two flares, planted by motor boats, were lit at the mouth of the channel. The enemy immediately sent up scores of star shells, but were too late. The cruiser Vindictive had already run in alongside the mole and, together with many motor patrol boats, was putting the landing parties ashore, and the concrete laden cruisers were fast approaching the canal, accompanied by destroyers and motor boats.

Before aid could be sent to the men defending the mole, the viaduct at the shore end was destroyed by running an old submarine loaded with high explosives under it and blowing it up. There were six men aboard, but they all escaped in a rowboat, to be picked up later by a motor patrol boat. At another point a submarine loaded with explosives was actually driven into the piling of the mole and blown up, this crew also escaping, to be picked up later by the motor boat.

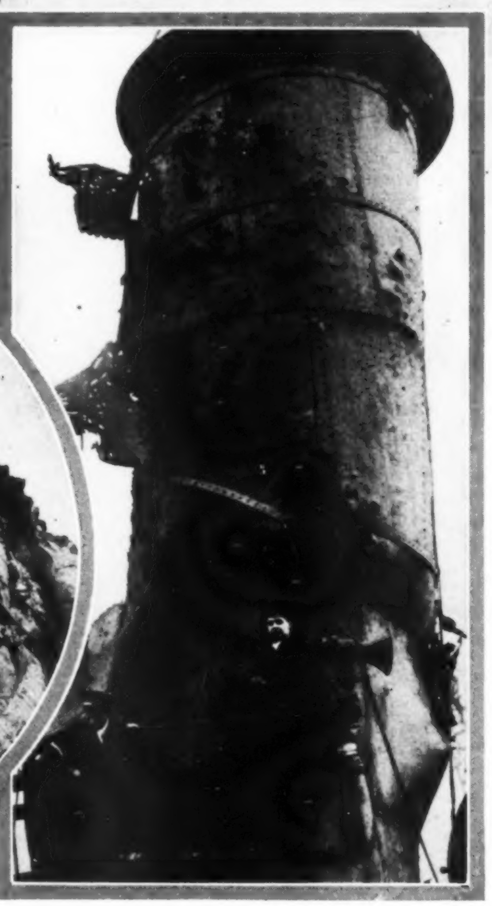
While the landing party was taking care of the men and guns and destroying stores on the mole, three old cruisers loaded down with concrete entered the harbor under a terrific fire from the shore batteries. One grounded just inside the mole, but the other two were run well up the entrance to the canal, swung across the channel and sunk. Each block ship was manned and navigated by nearly a hundred men, and when finally sunk were within a few hundred yards of the big guns of the shore batteries.

To take these crews off and out of the range of the shore guns while the ships were sinking was the most dangerous and difficult part of the whole raid—and American-built motor boats were assigned to this work. They came into the harbor at full speed, ran alongside the sinking vessels, took the crews aboard and made a dash through the barrage fire to the open sea. This was all done in a small harbor under the glare of searchlights and star shells and within a few hundred yards

(*Continued on page* 56)

American Built Motor Boats Lead Succ

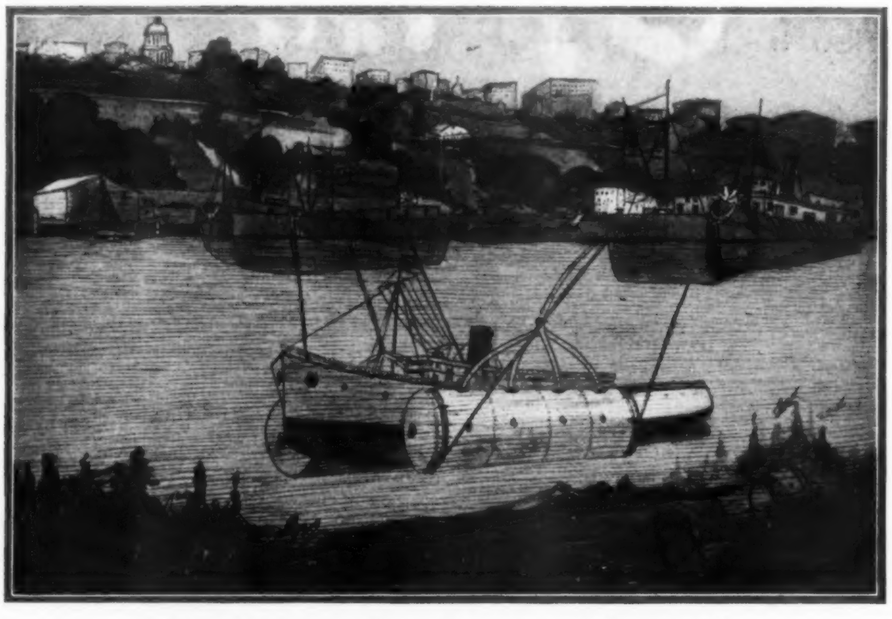
The fighting-top of H. M. S. Vindictive after the raid. Hit by a shell, five men were killed and three injured while operating the guns



Forward stack of the Vindictive, showing holes torn by shells. Some idea of the intensity of the machine gun fire from the mole can be gained from the manner in which the stack is perforated

Successful Attack Upon U-Boat Bases

At Zeebrugge not all the damage was confined to the mole and ships. Many shells and airplane bombs found their mark in the town and the German defences



The raising of a small vessel is a comparatively easy task

How Many Million Tons Can Be Salvaged?

Possibilities of Floating Some of the Ships Sent Down by the U-Boats Seen in a New Invention

WITH the progress of the Great War untold treasure is rapidly accumulating beneath the waters of European harbors and their entrances. The toll of the submarine represents a wealth beyond the dreams of romance. On the day hostilities are over, the work of salvage will commence on an unprecedented scale. The ingenuity of inventors is already directed towards the problem of raising the countless ships with their sunken treasure. It is estimated that sixty per cent. of the ships sunk lie in 300 feet of water or less. This depth presents tremendous difficulties for ordinary wrecking methods. To retrieve this fabulous wealth new methods must be found.

A very ingenious device, which has the merit of great simplicity and cheapness, has been granted an American patent which attacks the problem in a new way. In a word the deep sea wrecks are to be raised by buoyancy tanks which may be operated at great depths. The idea of buoyancy tanks of course is not new. The system has been employed by wreckers on sunken ships, large and small, for many years. The novelty of the new invention lies in the fact that it can operate at much greater depths than the conventional methods. A famous instance of such salvage was the raising of the submarine "F4" in Honolulu Harbor. She was raised from a depth of 270 feet, but only after being towed into shallow water. Divers first visited her, and attached chains for hauling her to a position where she was only 40 feet below the surface. Buoyancy tanks were then attached and she was raised with ease.

The pressure of the water at a depth of 300 feet or more is very great. A buoyancy tank of ordinary design would be crushed like the proverbial egg shell. To construct tanks which will stand this pressure would necessitate enormous expense. The construction would have to be of heavy steel reinforced by bracing.

The inventor of the new wrecking device solves the problem by an entirely new device. He has patented a buoyancy tank constructed of sheets of steel measuring but three-eighths of an inch in thickness. He builds tanks of two sizes with a lifting power of 150 or 300 tons, which are comparatively light and portable. The secret of their success lies in the fact that the internal and external pressure of the water is balanced in them, so that no crushing stress is exerted on the walls. It therefore becomes a simple matter to float down such tanks to the desired depth by adjusting the pressure inside them.

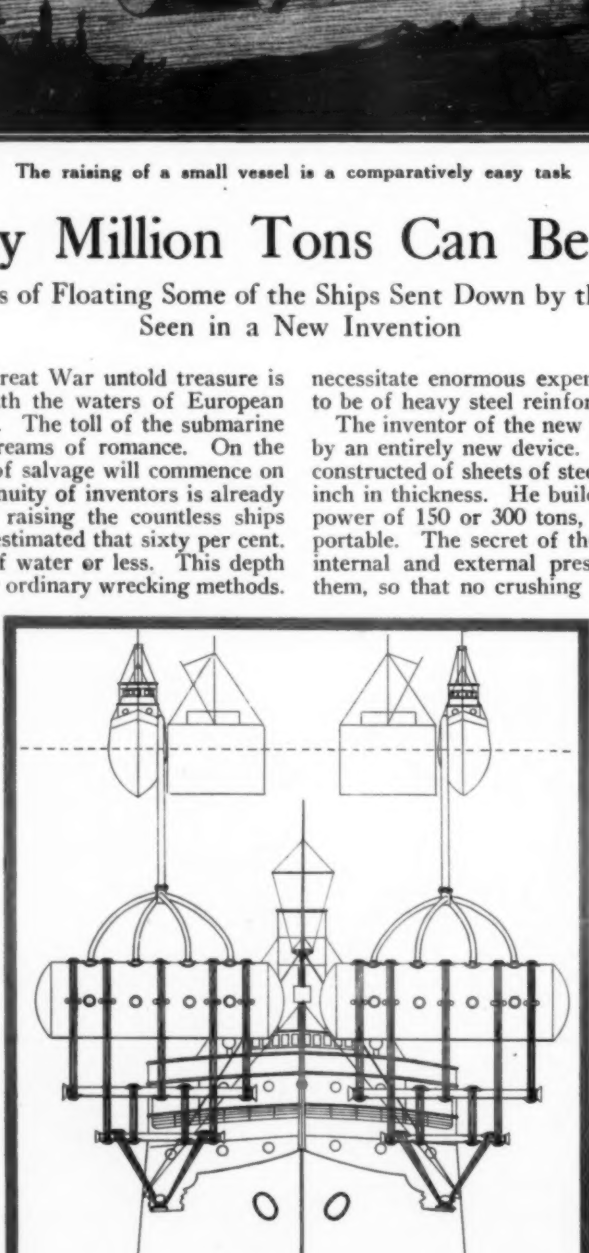


Diagram showing how the scheme works

By a simple arrangement of drain cocks the proportions of air and water may be readily adjusted inside the tank. The whole contrivance works automatically, so that as the tank is lowered and the pressure of water increases, the compensating pressure inside the tank adjusts itself. Without this device the tank would of course be crushed long before it reached a depth of 300 feet.

Water is admitted into the tank through a series of pipes placed at various angles, which makes the tank equally stable at any angle. If the tank should be tipped, while being lowered its buoyancy would remain unchanged. The wreck to be raised is first examined by divers. Diving suits are now available which enable men to work at a depth of 300 feet, and the Government is now testing apparatus which enable men to descend 400 feet in safety. The Ehinger tanks are then floated down to the wreck and firmly attached to the vessel, when the work of the diver is over. Air is then pumped into the tanks from a compressor at the surface. As the air is forced in, the water is

forced out until the lifting power is sufficient to raise the vessel.

Little difficulty is experienced in attaching the tanks. They may be securely fastened to the ship's side by passing chains through the port holes, through the anchor ports or to the rudder and propeller. If necessary holes may be drilled in the sides of the hulls. In the case of a very large ship, the tanks may be attached on both sides of the hull at the prow and pumped full of air sufficient to raise them a few feet, or even a few inches when chains are passed under the keel. A series of tanks may then be attached to the chains sufficient to raise the largest and heaviest vessel.

Exhaustive tests have been made with the tanks at various depths which prove their entire efficiency under the most trying conditions. As a special safeguard the tanks are subdivided into four water-tight compartments. Should one or two compartments be crushed in by the pressure of the water due to any accident, the two remaining compartments would still retain sufficient buoyancy to raise themselves and exert a strong pull on the wreck. Even should three of these compartments be destroyed the fourth would bring the tank itself to the surface.

It is estimated that twenty tanks of the larger size would be more than sufficient to raise a 6,000-ton ship from a depth of 400 feet. By using these comparatively small units the apparatus can readily be adapted to ships of any size. A battery of 145 tanks, each with a lifting capacity of 300 tons would be sufficient to raise the Lusitania which was of 45,000 tons gross weight. Since the wreck lies in but 245 feet of water, some twenty miles off the Irish coast, the work of salvage presents no very difficult problem to the inventor of this device. One of the great advantages of this device is that it may be readily adjusted to the side of the wreck. Many yachts and smaller vessels must be abandoned because the machinery necessary to raise them from considerable depths is very bulky and expensive, and would not pay for the trouble. By using two or more small stabilizing tanks, the work could be done at comparatively small expense. The cost of manufacturing the tanks complete varies from $2,500 to $6,000, which is trifling compared with the value of a single wreck. The enormous outlay of the great wrecking companies for machinery will be unnecessary with the new and simpler method.

No chapter of romance compares with the achievement of the wreckers who succeed in bringing to the surface the fabulous wealth which lies at the bottom of the sea. This wealth may be counted in billions, so that the imagination is staggered by the possibilities of such salvage. It is estimated that the Lusitania alone contains gold and jewels, which no water can destroy, valued at $50,000,000. The most thrilling tales of sunken treasure will seem commonplace by comparison with the everyday work of the deep-sea wreckers of the future.

Many schemes have been devised and patented for raising sunken vessels but few have proven a success when put to a practical test. One scheme that works very well in shallow water is to close all openings into the hull with the exception of one or two and then pump air into it; this forces the water out of the remaining openings until the vessel is buoyant enough to rise to the surface.

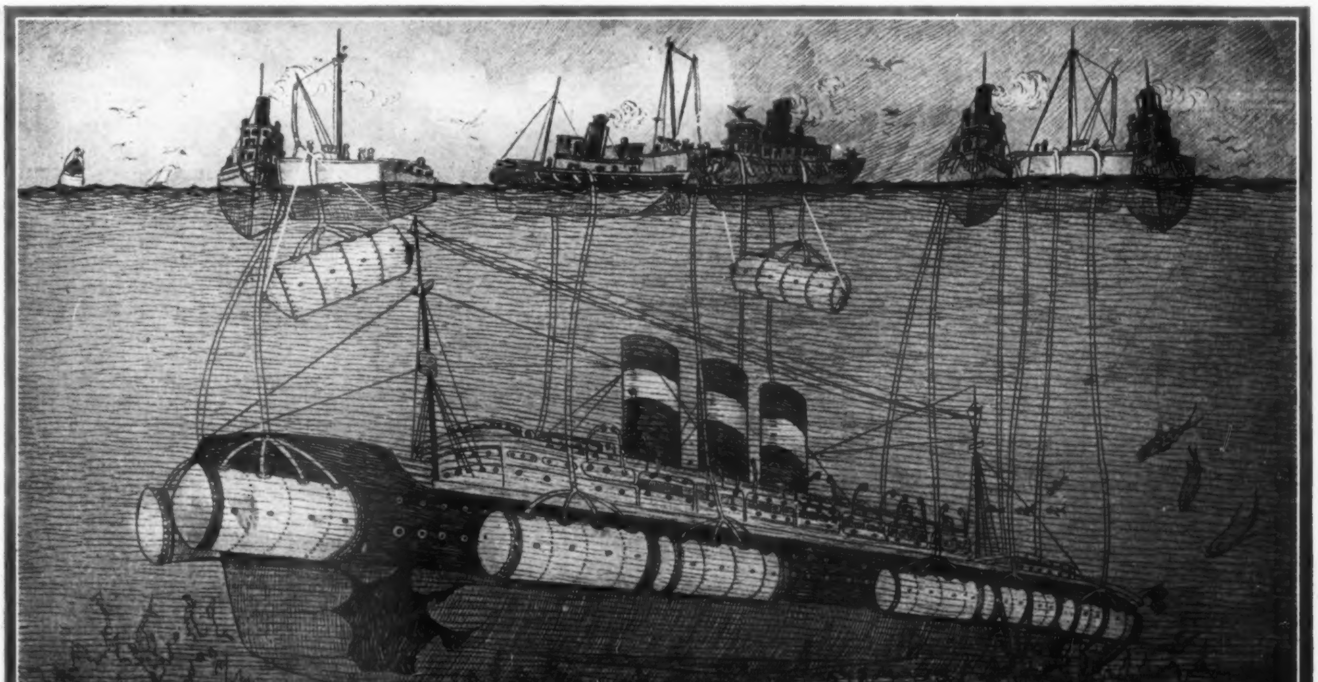
It can readily be appreciated that it is far from practical to close all the openings in a vessel lying on the bottom under 200 to 300 feet of water, especially if it had struck a mine or been torpedoed with the resulting large and irregular hole torn in the plates.

Until the U-boats started on their wild career of destruction, sinking millions in ships and millions more in cargoes, the recovery of the gold and silver bullion from the wrecks of the old Spanish galleons has lured many a man to try his skill in the game of treasure hunting.

Compared with the value of the ships and cargoes sent to the bottom by the Huns the Spanish treasure lost during the sixteenth century is a trifling sum, hunting it is now a game hardly worth the candle.

Many of the vessels that have been sent to the bottom in the shallower parts of the oceans will be raised and after a thorough cleaning and overhauling in a dry dock will be ready for sea once again. It is the engines and boilers that suffer most but even these can be put back into a serviceable condition again.

With the coming of peace and the slackening in the demand for steel it will be possible to build large numbers of these buoyancy tanks at comparatively small expense. The pumps and other gear for their operation is not elaborate and can be installed on any large seagoing tug or small steamship so that any number of these devices can be put into operation in a few months. To be sure, a large part of the cargo in the vessels sunk was food and other perishable material, but the gold and raw materials recovered should more than pay the salvage.



In order to raise the Lusitania or some of the larger ships, a more extensive equipment is necessary

Moving the Earth

The Effect Which Storms, Earthquakes, and Other Phenomena Cause—Methods Which Have Been Adopted to Record and Analyse the Movements

By E. A. Hodgson

THE Hindus have a theory that the earth is supported on the backs of great elephants. If they possessed a modern sensitive seismograph they would feel even surer of their theory, for this instrument reveals the fact that the earth is gently swaying backwards and forwards practically all the time, just as one would expect it to do were it resting on the back of an elephant. The series of wavering lines was made by a modern photographic seismograph of the form shown.

This instrument consists of a triangular plate of cast steel supported by three screws which enable it to be leveled. The double post has a little steel pivot P at the bottom which fits into an agate cup in the tube T. This tube is made of aluminum in order to be light and strong and bears a lead weight W half-way out. The tube is continued beyond the weight and carries at its outer end a vertical flat plate of aluminum which swings in the closed box B. The latter is provided with a slot in its front face to allow the tube to swing from side to side.

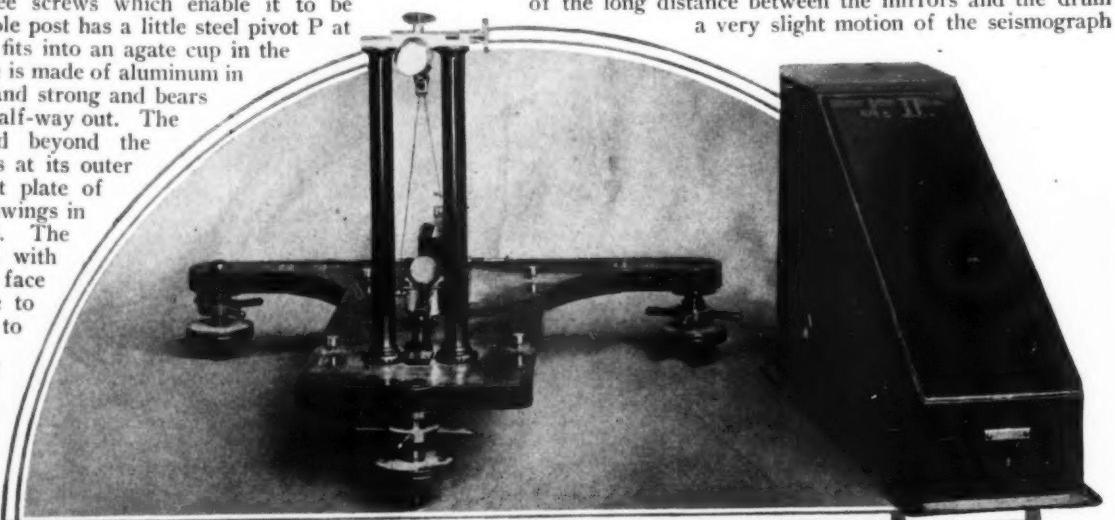
The function of this box will soon appear. Two fine platinum wires support the weight from the top of the pillars. Just over the point where the steel pivot and the agate cup form a joint there is a little mirror facing out between the two pillars. The top of the pillars is adjustable forward and backward, side to side, and up and down, by means of three screws and the closed box is also provided with adjusting screws to enable it to be so placed that the aluminum plate, which almost exactly fits it, can move freely without touching. The whole is mounted on a cement pier that goes down to bed rock.

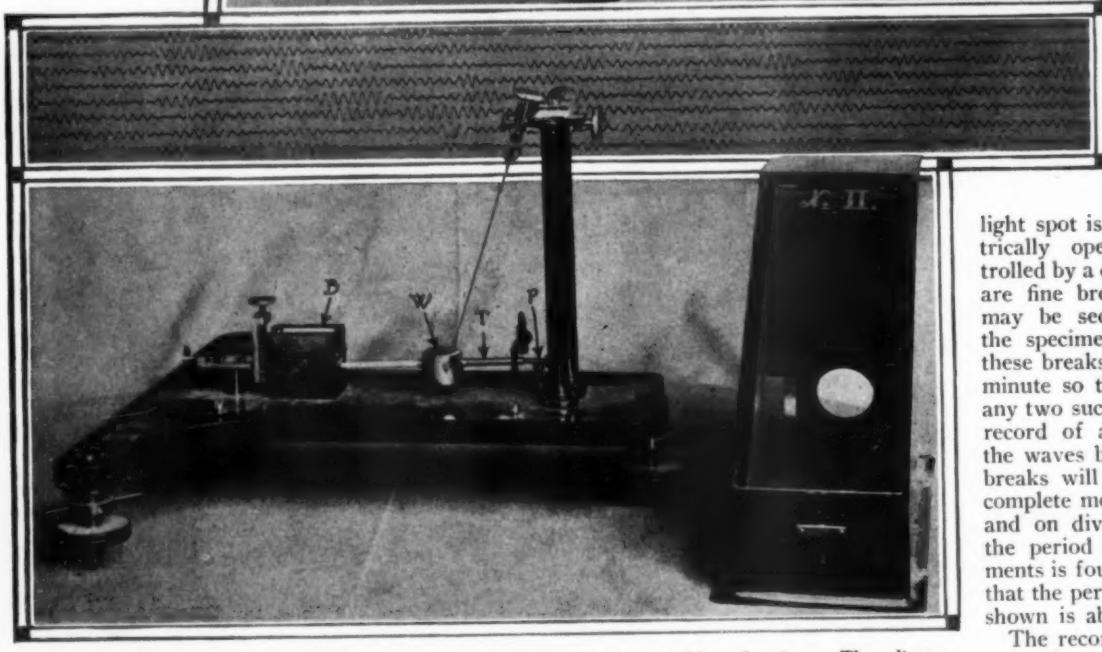
Now when the earth rocks backward and forward it sways the weight, the bar and the aluminum plate all about the point at the bottom and the supporting point at the top of the pillars. To prevent the seismograph from continuing to swing after the earth stops, the a'uminum plate swings against the air in the box B. This prevents the seismograph from recording anything of its own motion and is called the damping arrangement.

A fine point of light shines upon the little mirror and is reflected to a point some 10 or 15 feet away and falls on a sheet of sensitized paper rolled upon a drum which rotates with clockwork drawing out the spot of light into a line. If the earth were at rest this line would be straight, but if the earth moves the seismograph moves, swinging the mirror and swaying the point of light. The line now appears wavy. Because of the long distance between the mirrors and the drum a very slight motion of the seismograph is very much magnified at the point where it records.

At the end of every minute the light spot is shut off by an electrically operated shutter controlled by a clock and hence there are fine breaks in the lines as may be seen if one examines the specimen shown. Each of these breaks marks the end of a minute so that the line between any two succeeding breaks is the record of a minute. Counting the waves between two of these breaks will give the number of complete movements per minute, and on dividing this into sixty the period of the earth movements is found. It will be found that the period of the movements shown is about six seconds.

The record is much magnified as has been said; the actual earth movements in the case of this particular record being about .00047 inches. This is rather a large amount and the reason that it is great on this record is that there was a very large storm going on at the time on the Atlantic Coast. Now no wave that ever broke on the shore of the Atlantic would be capable of setting the earth in such violent vibration that it would carry inland more than a few hundred yards. But just as soldiers marching over a bridge would set it into dangerous vibration by their regular rhythmic tread, so the rhythmic wrshing up of the big waves during a storm gradually get the earth into a similar period of vibration. It is another illustration of the old statement that it is the constant everlasting keeping at a thing that produces results. We shall need to find some other name for our earth besides "Terra Firma."





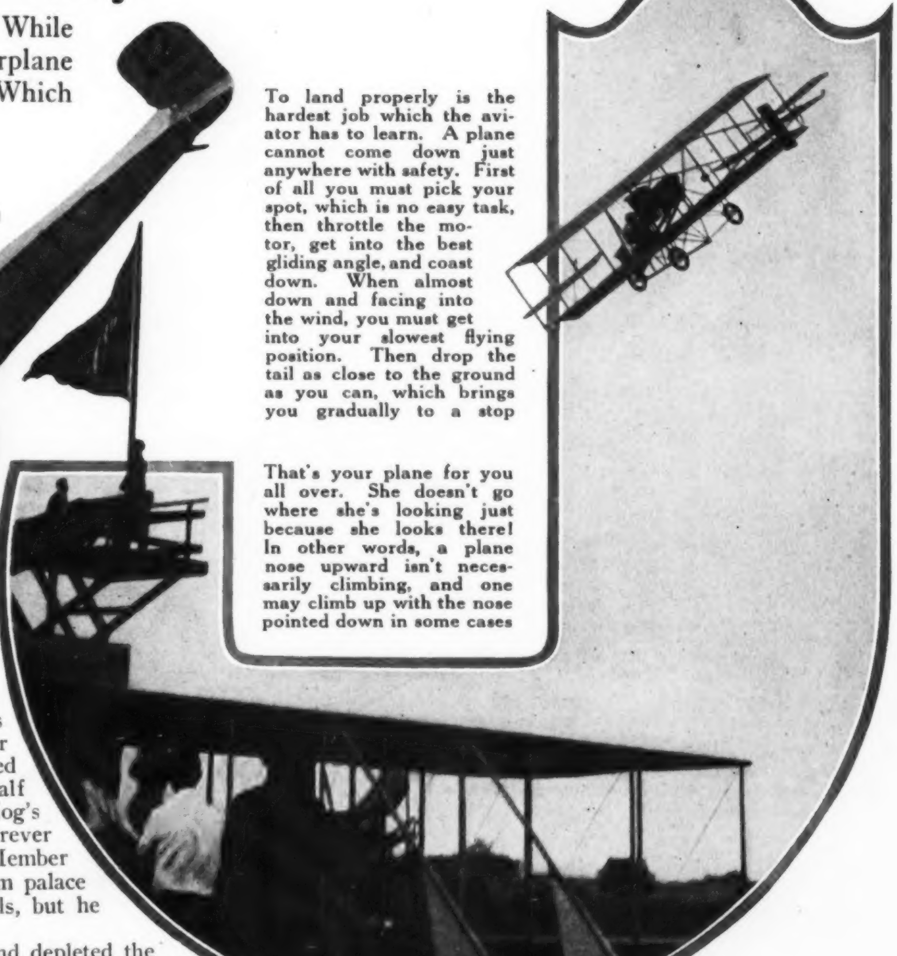
A modern photographic seismograph and its record showing the earth's vibration. The distance between the breaks in the line represents a period of one minute

The Air Pilot's Story

Sensations Which One Feels While Flying—Some Things an Airplane Will Do and Many Others Which It Will Not

By C. H. Claudy

Photographs by Underwood and Underwood



To land properly is the hardest job which the aviator has to learn. A plane cannot come down just anywhere with safety. First of all you must pick your spot, which is no easy task, then throttle the motor, get into the best gliding angle, and coast down. When almost down and facing into the wind, you must get into your slowest flying position. Then drop the tail as close to the ground as you can, which brings you gradually to a stop

That's your plane for you all over. She doesn't go where she's looking just because she looks there! In other words, a plane nose upward isn't necessarily climbing, and one may climb up with the nose pointed down in some cases

THEY were yachting in arm chairs, but they were not armchair yachtsmen. Speed Maniac's Delirious had won half a dozen motor boat races. The Commodore's Spreaded Wing had poked her white nose into half the harbors of a civilized world. Cup Hog's Get There was known and dreaded wherever 40-footers race and the Honorary Member wore the bars of an ocean-going steam palace on his sleeve. There was also Wheels, but he didn't count, being Only a Motorist.

The five sat around in arm chairs and depleted the contents of glasses the very names of which must here be deleted. And save for an occasional question, they were very, very quiet, for Wheels, who didn't count, being Only a Motorist, had brought the pilot with him to the club and the Commodore's tactful words had started him talking.

"—— so I got away." The pilot finished an absorbing story, "but if I hadn't had a machine that could stand on her ear without breaking her back I'd not be here!"

There was some very vigorous applause. Then, from the commodore. "Tell me. Is it hard to learn to navigate the air?"

"Wasn't a bit—for me," was the quick answer. "It's like sailing a boat or running a car—same chaps take to it easily and naturally, and others have to have it beaten into them with a club. I suppose it came easy for me because I like it, and because applied science and mechanics and dry-as-dust things like that don't bore me."

"That suggests a question." Speed Maniac is as ponderous in an armchair as he is nervously quick when sitting in a smother of foam at the wheel of Delirious. We hear a lot about the type of man who makes a good air pilot. The papers carry stories about the studying he must do and the things he has to learn. Yet before the war, the most successful fliers, in this country at least, were mostly circus performers and doers of stunts at county fairs. What's the answer?"

"Most of the stunt doing chaps get killed at it," was the quiet reply. "Unless they back their ability to do stunts with real knowledge. It's like this. The old time navigator got his knowledge by rule of thumb. Your windjammer captain of fifty years ago could read and write and use a sextant and scrawl lines on a chart, but half the time he got there by running down his longitude and then following his compass east or west until he made a landfall. He usually got there—but sometimes he didn't. Your stunt doer in the air gets there, as long as he doesn't run foul of a law he doesn't understand. When he does—well, there is seldom a second try for the man who stalls or pancakes or breaks his back in the air!"

"Tell us!" It was a general chorus. "Tell us about navigating the air. Tell us what you have to know in order to do what you have to do!"

"It wouldn't sound very modest if I said I couldn't, in an afternoon, would it?" was the smiling reply. "Yet I know none of you gentlemen could tell me all about a boat and how it is navigated, all you know of the sea and its ways, in an afternoon. I might sketch a little, if that would do——?"

It would do. The five drew their chairs closer. There was a finger raised and a white coat filled the depleted glasses with deleted liquids.

"Where shall I begin?" The pilot was somewhat embarrassed. After all, though a veteran, he was only a lad, and these were all older men.

"Dive right in!" encouraged the commodore, and "In the middle!" suggested Wheels, who knew him well. "Never begin at the beginning!"

"Shut up!" cried the pilot, good-naturedly. "Well, I suppose the hardest thing I had to contend with was to get it into my head that there was a real point in the story of the cross-eyed man who bumped into a negro on the street.

"'Why in Sam Hill don't you look where you are going?' the cross-eyed chap demanded indignantly.

"'Huh!' came the disgusted answer. 'White man, whyn't you all go where you's a-looking?'

"That's your plane for you, all over. She doesn't go where she's looking, just because she looks there! In other words, a plane pointed nose up in the air isn't necessarily climbing, and one may climb up with the nose pointed down, in some circumstances. Just because you use the rudder doesn't mean you come about in a plane any more than in a cat boat. And until the student can get it firmly fixed in his mind that line of flight and flying position of plane are not oriented together to stay put by any law of air or man, he can't make much headway towards learning to be a navigator.

"Mind you, I don't say this is the hardest thing to learn; it was what stumped me. It took me some time to get all my previous notions of moving bodies out of my mind. I'd yachted a little, and motored a little, and used to hike over the country in a motor cycle, and I've tobogganed and skiid and skated and all those things. They give you altogether a

In turning, the plane must be banked; but if it is banked too much or all of a sudden, it begins to side-slip, and if you don't bank enough, the plane skids

If you get off the course as plotted on your chart, without knowing it, you are as much lost as if out of sight of land in a rowboat with no compass or sun to guide you

false notion of aerial motion and inertia, because they all teach you the feel of motion plus the feel of the restriction of whatever factor confines that motion to direction—tire friction on the road, skate blade cutting into the ice, centerboard and keel in a boat, and all that.

"You get up into the air and you move in three directions, not two, as in all other means of navigation. And there isn't a blame thing to hold you to a course except such inherent stability as your machine may possess, and your knowledge. Take the veriest tyro and seat him at the wheel of a motor car and he can steer after a fashion, in five minutes. He turns the wheel to the right, and the car goes to the right, he turns it to the left and she goes left. If the speed isn't too fast, even the tyro is in no danger. But you can't do that way with a plane. There isn't any tire friction in the air to hold you to your course—to make you go the way you are looking. So if you were up with me skedaddling along at 60 or 70 m.p.h., and should try to turn a corner just by moving the rudder, you'd turn the nose of the machine the way you wanted to go, but the machine would keep right on going the way she wanted to go. Then things would begin to happen, right away. And if you didn't know how to help yourself, there would be no further flying for you.

"Of course! You have to bank," put in Wheels, "to go around a corner. So does a motorcyclist lean inwards or the car use a banked track for speed turns."

"Exactly," agreed the pilot. "But when the cyclist goes around a corner leaning in, nothing else happens. When he gets to the end of his curve he straightens up and goes on. But the plane undergoes a whole lot of stresses and phenomena in the air which makes it do strange things. For instance, it is hardly possible for the cyclist to overbank—to lean in so far he falls. But your plane can easily be banked too far. Then, all of a sudden, it begins to side slip—merely slithers down an inclined plane of air sidewise, having lost most of its forward motion, and unless you know how, you reach the earth so hurriedly that they ring for the junk wagon and the hearse without knowing whether or not they are needed.

"If you don't bank enough, the same thing happens as happens to a car going around a corner on a muddy street—the plane skids. If you must do one or the other, much better underbank and skid, than overbank and side slip. But how to do neither—how to get the "feel" of a turn, so you bank just enough—that's something only experience can give. It's like the yachtsman who knows just how tight to pull his sheet for every puff, just how much to pay off and ease off on the rudder for every flaw, just how to take advantage of every puff to get the maximum of forward speed on his course with the minimum of deviation from that course. Only the yachtsman, if the wind fails, merely stops. And if he fails, he merely loses speed. But if the pilot aloft makes a mistake he comes down!"

"Well, but you do have to come down, sometime. What's the harm if you have to come down because you overbank?" inquired the Cup Hog.

"Several things. In the first place, a plane can't come down just anywhere, with safety. It must come down on some sort of a flat field, big enough to run on after it lands. Even if the pilot is skillful enough to land at his minimum flying speed, he is still going pretty fast and he must have space enough to dry up that speed with his tail skid and a steep angle of incidence and a place smooth enough not to wreck his landing gear. In the second place, a side slip means coming down with a fall—you're lucky if you have space enough to turn it into a dive, so you can straighten out and not come down. When you come down on purpose you do so in quite another way. You first pick your spot, then you throttle down the engine, push your joystick forward to get into your best gliding angle, and coast down. You don't keep the engine going because you come down by gravity fast enough, and you want to land slowly, not rapidly. When you are almost down, and facing into the wind, you pull on the joy-stick until you get into your slowest flying position. Here you should be about 5 feet off the ground, and with the machine perfectly level. As the engine is just turning over or shut off, you lose headway, and alight. Then you drop the tail as close to the ground as you can, to give the maximum angle to the wings, which increases the resistance and brings you gradually to a stop. It sounds simple, but there is no flying manœuver harder for the tyro to learn than correct and safe landings, and keeping one's eye forever on the landscape to pick a landing field is one of the first things we are taught. No competent pilot is ever without a landing possibility in his mind. He always has foremost in his thoughts, 'The engine may fail. If it does, where shall I land? That field looks good—no, trees? The brown one, then, stubble. Is that grass long or short? There's a likely place, but—are those hair lines fences? No—yes—if I come down I'll go back to the last one—no, there, just ahead is a wide level stretch—and so on and so on.'"

"You spoke of 'slow flying speed,'" put in Wheels. "Can you regulate the speed of an airplane? I thought they just went at the one rate."

"Gracious, yes!" was the laughing answer. "We are not as crude as all that. Every plane has a maximum possible speed and a minimum possible speed, a best climbing angle, a best gliding angle, and an optimum speed, which is the most effective flying speed—that is, the speed attained when the plane is in its best flying position with the amount of engine power in use which keeps it in that flying posi-

tion. Take the slow plane I am using now for experimental work. In good air I can get up to 71 miles an hour. Then my engine is 'all out' and the angle between the chord of our planes and the direction of motion is small—about two and a quarter degrees. But this plane isn't built to run at that speed most efficiently. She is slightly nose down flying on a level at that speed. Her optimum speed is about 55 miles an hour, when the angle is about seven or eight degrees and the motor partly throttled. If I nose her up so I get a fourteen-degree angle I can drop to about 45 miles an hour. Then, though I am pointing skyward, I am not climbing. I am just staggering along, using all the motor power I have, burning gas hand over fist and going at my slowest. It takes much less power to go 55 miles an hour in this plane than 45 miles, because the only way I can slow up to 45 miles is to increase my angle, thus increasing my resistance, while increasing motor speed to overcome the resistance and provide the lift, until the motor is working its hardest and the plane dragging back at its maximum.

"And here is where that first hard lesson I learned comes in. Here I am, staggering along, nose in the air, on a level. Engine is doing her best. But I neither rise nor fall. If I want to rise, I must point her nose, not higher up, but nearer the horizon! Then I get to the best climbing angle, which in this plane makes the wings tilt to the direction of motion about six degrees. My speed immediately picks up, due to the increased engine power, due to the decreased resistance. Increase of speed and decrease of resistance mean increased lift—and up I go!"

"That's a tough one!" The Honorary Member spoke for the first time. "Your plane seems a somewhat contradictory sort of mechanism!"

"It's one large bundle of contradictions. Another odd little thing we have to learn is the 'inversion' of rudder and elevator. You know we steer in four directions, against the two of any land- or sea-going vehicles. Boats, motor cars, skaters, etc., steer to right and left. We steer to right and left and up and down. So we have two rudders, to a ship's one, though we call the other one an elevator. The rudder on a plane is like the rudder on a boat and works on the same principle. The elevator is a horizontal rudder. But sometimes the elevator becomes the rudder and the rudder becomes the elevator! If one banks very sharply indeed, as in making a very short turn, which one may do if one has great speed and considerable confidence in the plane—if one banks very sharply indeed, one is, for the time, almost standing on edge. At that time the elevator is perpendicular and acts like a rudder and the rudder is horizontal and acts like an elevator. We have to learn not to use the wrong one, because a mistake here may mean hurtling into a spiral, and while spiralling is a perfectly legitimate and safe way of coming down if you know how and are prepared and the plane will stand it, a spiral dive which you don't understand, or in a logy plane, may mean a disastrous landing."

"How do you mean, if the plane is 'logy'? What's 'logy'?"

"Hard to handle—slow to respond. Planes differ in the responsiveness to the controls just as boats do. And, like boats again, they differ in their response according to their speed, and the power being used to drive them."

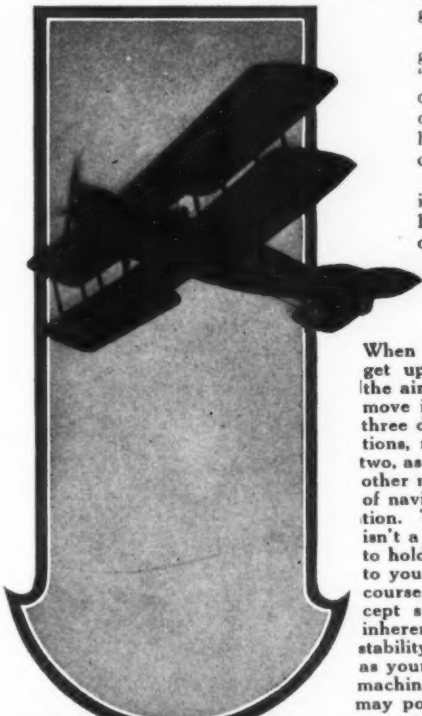
"Why, you haven't but one source of power, have you?" said Speed Maniac, who can think of power only in terms of gasoline engines.

"Indeed we have. We have gravity, as well as the engine. If I am several thousand feet up and want to come down, I drift down. The gliding angle of this plane I am using now is about one in seven—that is, with motor cut off or just turning over, I can go forward seven feet for every one I drop. But the machine handles entirely differently, even though it is moving at its accustomed speed of about 55 miles an hour. It handles differently because there is no blast from the propeller coming back against the controls. When I am moving forward on a level, or climbing, I have the air blast from my motion—in this case a wind of 55 miles an hour, plus the air blast from the propeller. The absence of that blast makes the machine handle differently, and I have to know how differently and allow for it; otherwise I won't get the result I expect. And there is nothing more terrifying in the air than failure to get the result one expects. It's like turning the wheel of a swiftly moving motor car and getting no result from the steering."

"I'd like to know something of actual navigation of the air," said the Honorary Member. "All that you have been telling us is operation of a plane. But how do you navigate? How do you find your way? How do you know how to steer at night or when above the clouds?"

"Like all the rest of air work, navigation is contradictory, too!" smiled the pilot. "Unlike the navigator at sea we can't take an observation or plot our position on a chart. We can fly only by sight, by compass, using a map, of course. Yet we lay out our course and try to follow it, just as a navigator does at sea. Only we lay it out with reference to the ever-present fact, which but few fliers appreciate, that an airplane has motion with relation to the air, not with relation to the earth. The most powerful ocean current is slow compared to the speed of a steamship, but the air pilot navigates an ocean in which currents may equal or exceed his own speed. Consequently, the wind, its direction and velocity, is of great importance in laying out a course. Suppose I am at a town—let us say Landingville. I want to go to another town, call it Journeysendburg. The distance between the two is 225 miles. Journeysendburg is directly northeast of Landingville. If the air

(*Continued on page* 56)



When you get up into the air you move in three directions, not two, as in all other means of navigation. There isn't a thing to hold you to your course, except such inherent stability as your machine may possess

No competent pilot is ever without a landing possibility in his mind. "Where shall I land?" is always foremost in his thoughts. "That field looks good. No, trees. The brown one — there's stubble. Is that grass long or short? There's a likely place, but—are those hairlines fences?" And so on and so on

Aviation in the Far Corners of the World

By M. Edward

AVIATION has spread to the far corners of the earth. In the U. S. A., the home of aviation, it would seem strange to think that a far-away place like South Africa should have an aviation history. A small one it is true, but especially interesting coming as it does from the "dark continent."

It begins around 1910 when Kimmerling arrived in Johannesburg, South Africa's largest city, 1,000 miles from Cape Town, the chief port. He came to exhibit his Voison biplane, a type that had proved successful on the continent the year before. Of course the population were thrilled at the idea of seeing a real flying machine that had done great things in Europe. Wilbur and Orville Wright had been seen flying—in the picture houses.

Major Millar, who is recruiting Boers and Britons in British South Africa for the Royal Flying Corps

When Kimmerling first arrived he had no real intention of actually flying. He was more of a mechanic than an aviator and came with the idea of exhibiting the machine in the light of a business venture. However, he found that everybody expected him to fly, and fly he did. When it is taken into consideration that Johannesburg is about 6,000 feet above sea level, it appears that he must have taken a considerable chance, as he had not had much flying practice before. The thin air up in the high-veld—as this part of South Africa is called—is even now considered very dangerous to fly in without plenty of experience in its patchy ways.

Kimmerling only flew a few hundred feet above the ground, but he caused some sensation. Thus great success attended his flying, but he had bad luck in other ways. He has the unique record of having his machine legally attached for debt, by a well-known firm of Johannesburg attorneys. He went back to Europe early in 1911 and became one of the famous pioneers there and a very daring flyer.

About the time of Kimmerling's visit there were a few other enterprising people interesting themselves in aviation possibilities in South Africa. Two societies were formed, proving that even at that early date the thought was pretty general that aeroplanes were to be considered one of the Twentieth Century's forms of traction. A man named Christaens started the South African Aeronautical Society, that is still in existence but not going strong on account of the war, all aviators and machines being needed in the Royal Flying Corps.

Christaens was a man well known in motoring circles in Europe, and he won the Liederkerke Cup among many other motoring honors. Like many other prominent motoring men of his time he decided to go in for aviation. He went to Henri Farman's flying school for tuition not very long before his South African visit. He has seen service in this war and had the unique experience of being captured by Germans and getting away again. He was released by the authorities from military service to drive a Sunbeam car in the big American races last year—1917.

The other society formed was the Aviation Syndicate. The promoter of this was John Weston, one of the first aviators in the country, actually the first real South African flyer. He is of American parentage, born in Zululand. With the other members of the Syndicate, Messrs. Livingstone, Compton Paterson, and Driver, he took over a Bristol biplane of the cross-channel type that Christaens was using, and later, in 1912, obtained two other machines.

Driver brought out a Bleriot, famous then, and Paterson made a machine in the country of his own design, sending to England for a Gnome engine. The first aerial mail delivery to take place in South Africa was by Driver in December, 1911, when he carried a mail bag from Kenilworth to Muzinberg (suburbs of Cape Town) a distance of ten miles or so.

It goes without saying that by this time there had been many accidents. Paterson had a smash-up that very nearly finished him at Cape Town. Almost at the same time Driver had a bad spill through an overheated engine treacherously continuing to fire after he had shut off to descend.

C. J. V. Bredell is the man who claims he was the first South African born to fly on a machine made in the country. His monoplane was made by Alfred Raison, a clever French mechanic still in Johannesburg, who has interested himself in practically every machine built in the country. Mr. Raison constructed Bredell's machine without a model or any real working instructions—just from a general idea contained in a letter from a friend of his who was working in a Paris aeroplane factory. This was his first attempt at aeroplane building.

Bredell and Raison first became acquainted through a mishap to the former's car sixty miles from any large town. The damage was of such a nature that Bredell felt sure of a night on the lonely veld when he chanced upon Raison, who happened to have a small motor store in the neighborhood. He cast new bearings necessary, and generally proved himself so skilful that the two became fast friends from that day on.

Some months later Bredell bought an aeroplane engine from an enthusiast who had manufactured a machine from iron tubing, and been unsuccessful. Although he had never flown before and knew little about the science he decided to build a machine to the engine. So he got hold of Raison and the two of them turned out a very presentable monoplane for the time. The engine was a J. A. P., a British make of only 16-20 h.p. and the machine weighed 400 pounds com-

One of the first pictures taken from an aeroplane of Johannesburg, South Africa; a re tained by the aerial photographer, showing that the City is laid out on the American sys Toward the lower left-hand corner five street

plete. Hopelessly underpowered according to present day ideas.

The planes had a 30-foot spread at an angle of 7 degrees and a chord of 6 feet. The length of the body 27 feet, the width of the back plane 12 feet, and the rudder 4 feet square. They used South African ash for the woodwork, and the ribs of the planes were cut out of a solid piece and fastened without glue or nails, being forced on to the horizontal member connecting the planes. The planes themselves were of Continental fabric of 2,200 pounds warp. The controls were: throttle, air lever ,and advance spark, and the joy-stick. The machine carried one passenger.

The design of this monoplane proved really good, but owing to the low-powered engine it never flew very high or well. Nevertheless it was a wonderful piece of work by men who just went on illustrations and nothing really technical.

The South African Aviation Society started an aviation school which was successful until the outbreak of the world's war in 1914. Most of its members joined up for the front and the few aeroplanes

(*Continued on page* 55)

Picture taken by captured German aviator—Dropping bombs on a British camp in the German South West African Campaign in 1915

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tably clear and detailed view of the City has been ob-
of squares. The City Hall Gardens can be seen.
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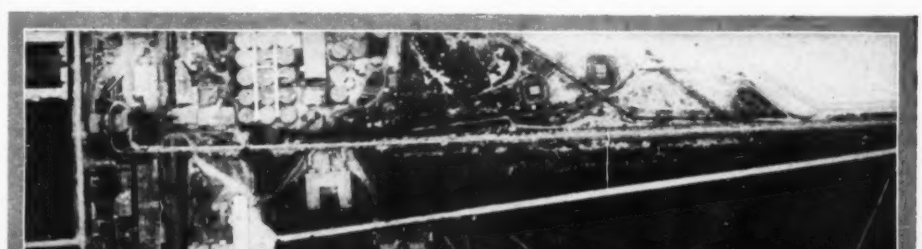
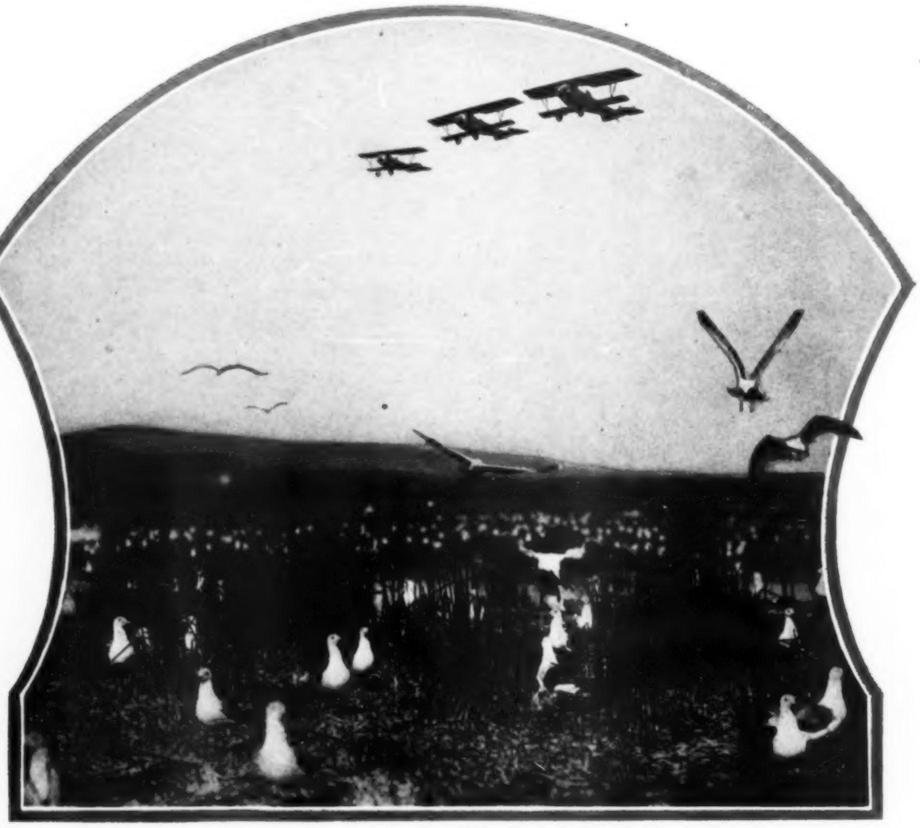


The village deep gold mine in Johannesburg, one of the world greatest mines. The cyanide tanks of the reduction works show at the top, and the quarters of the married men workers are seen ranged round a park



Let Loose the Gulls of War

By John Walker Harrington

THE gull is not a man-of-war bird, but all the same he is a natural born submarine detector. Being one of the best of the aboriginal hydroaeroplanes, various schemes have been proposed for utilizing his sharp eyes and his insatiable curiosity against the U-boats of the Hun. The British Admiralty has considered what might be done with the aid of his numerous tribe, and our own Navy Department has on file the suggestion of Dr. D. A. Pentz, of Staten Island, who has for many years been a student of the gull and his ways. The doctor has even invented a device for training the winged scouts of the sea to always be on hand when there are submarines in the offing, and to give notice to the vigilant patrols.

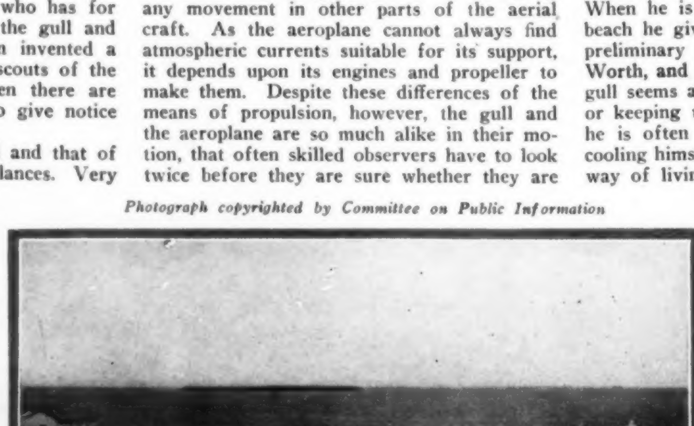
Between the flight of the gull and that of the aeroplane are marked resemblances. Very often on the street corners, men and women may be seen craning their necks toward the blue sky in the belief that they are seeing a squadron of flying machines, when in reality, they are following the progress of a few gulls. The gull is a glider, and although he does not soar, he so skillfully balances himself in the currents of air, that he appears to do so. If he did not occasionally stir up the atmospheric molecules about him, he would volplane slowly to earth or sea. His engine is one of the lightest and best in all birddom, for his breast muscles weigh only sixteen per cent. of the whole weight of his body, as compared with the forty-five per cent. observed in many other avine aviators.

As a monoplane, he consists of two very well-balanced planes, and a feathered empennélage. His tail is an A-1 rudder. He gets the highest efficiency out of simple equipment and minimum power, and that is why his flight seems all grace and ease. If he had only a propeller in his head, he would be a perfect mechanism. The man-made flying machine, however, has made good the neglect of Nature to create birds and animals in two sections. The conquest of the air has been due to the fact that motion may be imparted to propellers, without setting up any movement in other parts of the aerial craft. As the aeroplane cannot always find atmospheric currents suitable for its support, it depends upon its engines and propeller to make them. Despite these differences of the means of propulsion, however, the gull and the aeroplane are so much alike in their motion, that often skilled observers have to look twice before they are sure whether they are seeing distant aeroplanes or nearby sea fowl.

As a hydroaeroplane, the gull is a complete success. When he does not care to fly, he rests upon the surface of the water. Although he has web feet, as has the duck, he sits higher than most marine fowl, as though he were just about to get back again into his favorite element. When he is ready to fly from his damp refuge, he moves his feet swiftly, flaps his wings a trifle, and up he goes. When he is taking his flying start from the beach he gives a little run, equivalent to the preliminary taxi we see at Mineola or Fort Worth, and he is soon soaring. Although the gull seems always to be flying over the wave, or keeping up with vessels, hour after hour, he is often taking his ease on the swell or cooling himself upon the convenient flow. His way of living, sleeping, and resting, make it possible for him to be in mid-ocean when he feels like it. No matter where warships go, the gulls can continue to be true fringes of the fleet.

The sight of the gull is as keen as that of an Indian hunter. He is an all-around good scout, and there is really nothing of importance on the sea or reasonably far beneath it, which he does not see. His vision is sharpened by his appetite, for to him all objects, great and small, are food prospects. When he sees a whale or a shark, he scents a dinner. The big marine animals and fishes in taking the small fry into their capacious systems, kill or maim more than they swallow, and the gulls are always on hand for the leavings. By some strange instinct, also, gulls will appear in great flocks in the wake of ocean steamships just about meal-time, for they are thrifty creatures and

Photograph copyrighted by Committee on Public Information



Planes ready to put to sea from an American port upon the first signal

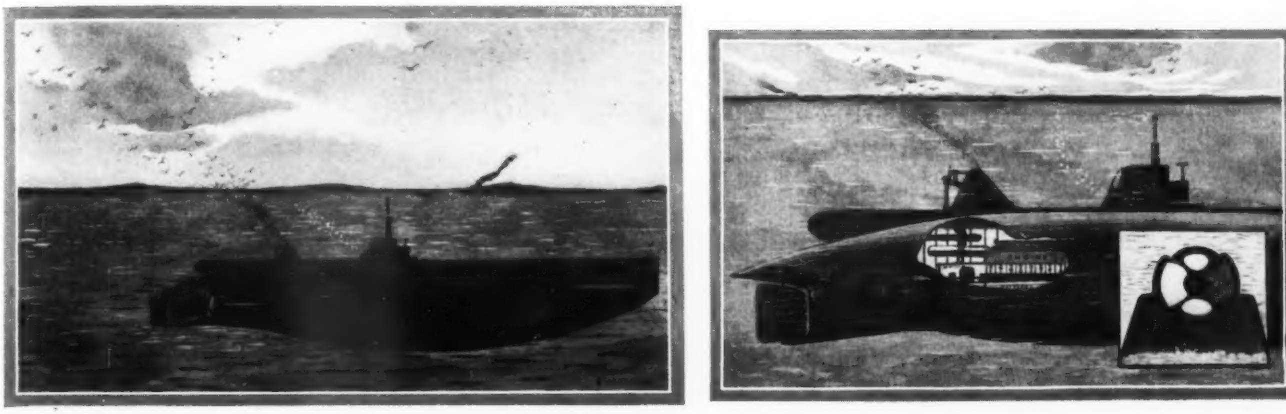


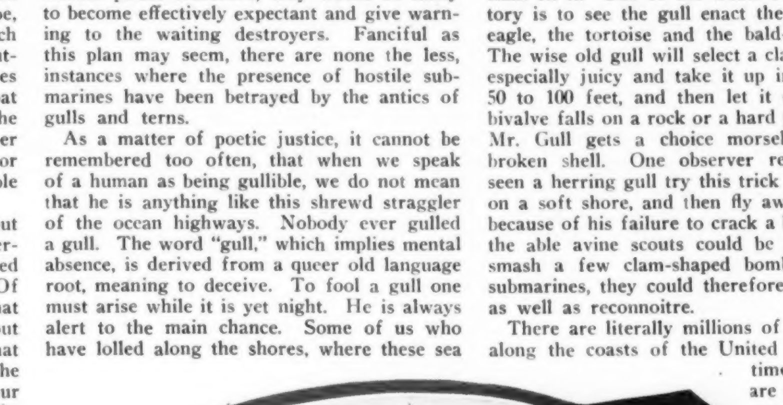
Diagram of how sea gulls might be used to detect the presence of submarines

able scavengers. Now, a submarine, taking the gull's eye view, might be either a vessel or a sea monster. He really does not care, if its presence involves something to eat. Whenever the wise sea bird sees a periscope, he wonders what is likely to float up which might be edible. He takes in the whole outline of a submerged submarine, just as does our flying navy on clear days. Many a U-boat has gone to the very bottom shelf of the locker of one David Jones, because of either a bomb dropped from a hydroaeroplane, or the quick hint which some sky pilot was able to give to destroyers.

When there was so much discussion about the coming to these shores of the super-submersibles of Germany, Dr. Pentz evolved his idea of utilizing the gull for defense. Of course, he did not take into the account that the birds would be just as inquisitive about American submarines, but he believed that such was the necessity for counteracting the von Tirpitz frightfulness, that the few of our under-sea fighters in commission need not be taken into the equation. As the gull is inclined to associate food with submerged objects, it is proposed to play upon its appetite by seeing that the bird was never disappointed. The doctor made an effort to borrow a submarine from the Government for this purpose. His device is a carefully modeled bait trap, that is a contrivance of sheet steel shaped not unlike a barrel, with a tapering top. Into this receptacle he proposed to place cut-up raw fish, preferably a trifle passé. There are small holes at the bottom of the tank which will admit the water of the sea and float the bait. When it is desirable to practice the gulls in submarine scouting, a portion of the bait can be released through a valve in the top of the box. The quantity is limited and standardized by the form of valve. The releasing contrivance is controlled by a rod which passes through a well packed joint into the submarine, where the requisite turn can be given by a sailor with a crank. As the fragments float to the surface of the water, the gulls are attracted to them. When they see any submarine pirate therefore, they would be likely to become effectively expectant and give warning to the waiting destroyers. Fanciful as this plan may seem, there are none the less, instances where the presence of hostile submarines have been betrayed by the antics of gulls and terns.

As a matter of poetic justice, it cannot be remembered too often, that when we speak of a human as being gullible, we do not mean that he is anything like this shrewd straggler of the ocean highways. Nobody ever gulled a gull. The word "gull," which implies mental absence, is derived from a queer old language root, meaning to deceive. To fool a gull one must arise while it is yet night. He is always alert to the main chance. Some of us who have lolled along the shores, where these sea fowl are not disturbed, have observed the ingenious ways they have of getting all the food value of the landscape, especially if it has a clam on it. One of the treats of natural history is to see the gull enact the fable of the eagle, the tortoise and the bald-headed man. The wise old gull will select a clam that looks especially juicy and take it up in the air for 50 to 100 feet, and then let it drop. If the bivalve falls on a rock or a hard packed beach, Mr. Gull gets a choice morsel out of the broken shell. One observer reports having seen a herring gull try this trick sixteen times on a soft shore, and then fly away in disgust because of his failure to crack a breakfast. If the able avine scouts could be persuaded to smash a few clam-shaped bombs on hostile submarines, they could therefore fight for us, as well as reconnoitre.

There are literally millions of hungry gulls along the coasts of the United States at all times, and they are especially greedy in the (*Continued on page* 58)



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Welcoming the safe return of a seaplane which was sent on an important mission

Plane Facts

The Third Instalment of the Series Dealing with the Fundamental Principles of Aircraft and Flying

By William B. Stout
Technical Advisor to the Aircraft Board

PREVIOUS articles have discussed the analogy between boats and airplanes, both from a standpoint of displacement of air or water, and of the requirement for separate types of design for either speed or cargo capacity.

We have found that a plane, like a boat, is supported in proportion to the amount of weight which it displaces. We have also found that a blunt-nosed wing, like a blunt-nosed boat, is of small use for speed, but has great lifting capacity. If you design the plane with a sharp-nose penetrating wing, we find while we have obtained speed, we have sacrificed lift and cargo.

Having analyzed, therefore, the use and theory of wings, we are ready to study the arrangement of these flying surfaces in order that a plane may support itself in the air.—EDITOR.

FIRST comes the arrangement and shape of the wing, and the factors which control this are illustrated in the separate views of Figure 1.

A first important consideration after the wing curve itself has been selected is the plan view—the relation of length to width. If a plane is 6 feet long and 1-foot wide, or, in aircraft terms, has a span of 6 feet and a wing chord of 1-foot, then the proportion of length-to-width or span-to-chord is six to one. This proportion is called the aspect ratio and is ordinarily in the neighborhood of six to one.

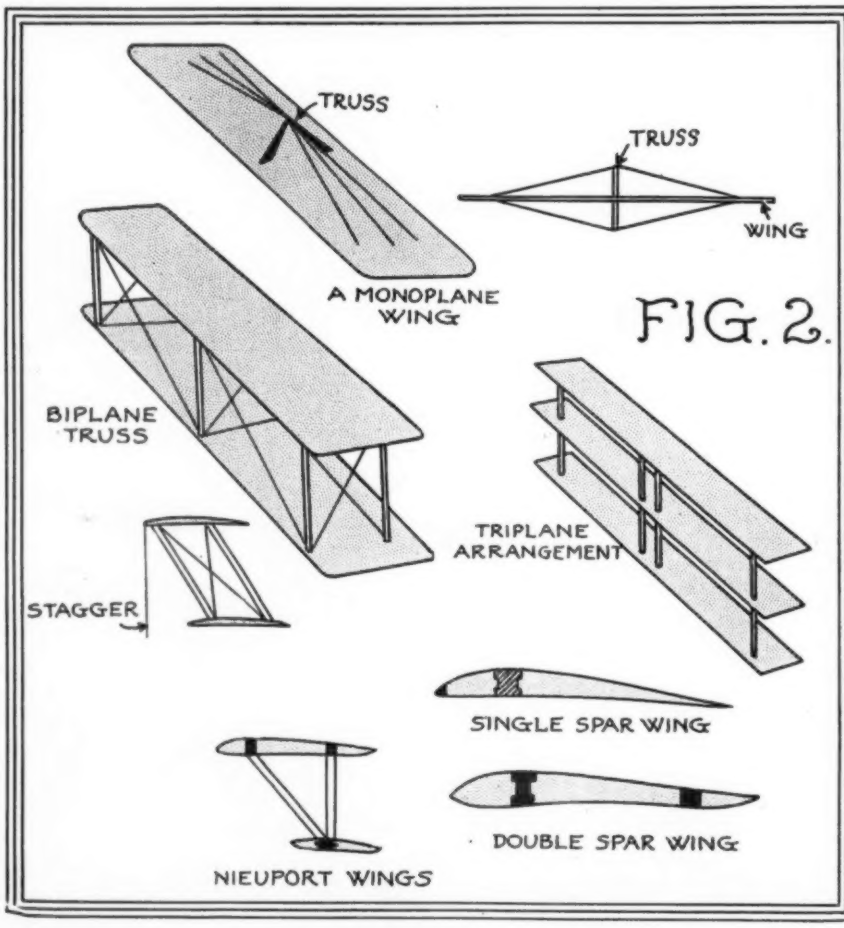


FIG. 2.

There is a definite reason why a wing must be long in proportion to its depth. The drawing at (A) shows the wing of six-to-one aspect ratio. At (B) is shown one of the wing tips with lines (L) representing the current of air flowing past the wing as it flies as shown by the arrows. Since this wing is supporting the plane, there is a pressure under the wing and a vacuum over the wing, so that the air underneath tends to slide around the edge and onto the top. Thus the air striking the front edge of the wing near the tip, leaks over the end as shown, making this end of the wing the least efficient of any section of the plane. One can see at once that the longer the end of this wing is, the greater the loss would be. With an aspect ratio of three to one—a depth of one-third of the length—there would be almost double the loss.

There are some exceptions to this, since there is a certain time element to the tip loss, and at very high speeds there is reason to believe the loss is much less than at slow speeds, but since one must have the slow speeds for landing the problem still holds even for high-speed planes.

(C) shows a conventional wing-end construction with a rounded tip slanting down from above. This makes a fairly efficient wing end but means special ribbing and production difficult. The more modern method in use by both Germany and the Allies is shown at (D) where the wing section without change is merely sliced off at an angle of about 15 degrees, and a strip of wood (S), either semi-circular or triangulâr in shape, is fastened onto the end. This makes a very simple building job for the factory—an angle which must always be given major place in the designer's analyses—and still fulfills the aerodynamical requirements for efficiency and lift.

Having selected a wing curve and the aspect ratio for a wing, we are ready to analyze the placement of this plane and what is usual in the matter of arrangement. Before discussing the whys too deeply, we can glance at usual present practice.

Wings, nowadays, are arranged singly, or with one or more superimposed on top of the other. With one wing only, we have a monoplane. This is a type which was common before the war and which is exceptionally attractive to the designer through its resemblance to nature's airplane. It is a difficult type to build, however, with sufficient strength for the wing spars; these, as will be explained later, being comparatively light in weight and subject to unusual stress. To support them, a number of outside guy wires have to be attached to a central frame, these wires and frames forming a great resistance to forward travel.

On account of the limitation of spâr strength, the span of a monoplane is comparatively small, so that to get the area necessary for flight the aspect ratio must be low. This means a large wing-tip loss at slow speeds, so that monoplanes ordinarily have a higher landing speed than other types although they are usually capable of high speeds once they get into the air.

Due to the great number of problems connected with the development of monoplanes at the beginning of the war, and since something had to be built which was immediately available for maximum performance, biplanes took precedence almost at once. In this type there are two planes, one above the other, separated by wood or steel struts with cross wires, which make the whole structure into a form similar to a box truss bridge. This gives a structure of enormous strength in a very light weight as is shown in Figure 2.

There are a number of disadvantages to the biplane. Its structure and wires offer considerable head resistance. Its lower plane lifts only forty per cent. of the total, sixty per cent. being the share of the upper wing. This is due to the fact that the upper surface of the wing—the side producing the vacuum—is the most important. The upper wing produces the greatest vacuum since the lower one is hindered by the struts and wires and by the fuselage or body location.

This type of construction, however, can be built in great sizes—some of the recent Allied and German machines being close to 100 feet in span—and can be given many margins of safety. It might be well at this point to explain what I mean by factor of safety or margin of safety in a plane or engineering structure.

Suppose that the flying load of an airplane is to be 7 pounds per square foot. This might be a 500-square-foot airplane with a total weight of 3,500 pounds giving a load on each square foot of 7 pounds. It certainly would not do to design a machine to carry only this 7 pounds, as when a pilot dives and straightens out again the load on his wings may be three or four times the flying load, and if he wished he could make it much more. Ordinarily bombing machines are designed with a factor of safety of about six. This would mean for our 7-pound plane, we would have to have a structure which would hold six times 7 pounds per square foot, or 42 pounds. This is designed mathematically as one would design a bridge truss; the plane is built complete as it is meant to fly, and then sand tested.

This is done by turning the plane upside

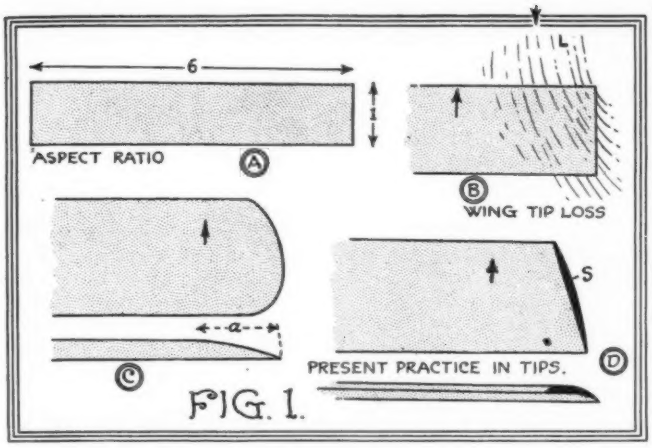


FIG. 1.

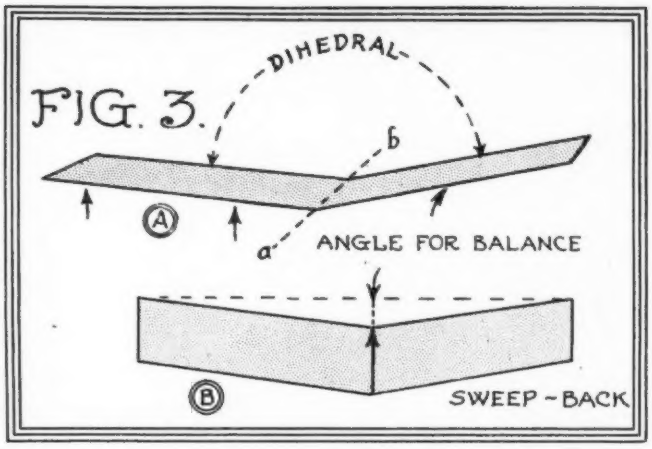


FIG. 3.

down, supporting it from the fuselage or body. Sand bags are then loaded on the wings until every square foot of flying surface has 42 pounds of sand, or seven times the flying load. If the plane does not stand this load, it is not strong enough for flying use. This visualizes how we have developed the structures which are now used on airplanes as compared to the early experimental machines, built in barns and backyards by experimenters who knew little of testing and who went mostly by guess so far as their judgment of machine or safety was concerned.

A biplane gives the pilot a better vision of the air than can be obtained in a monoplane. In a monoplane, one can see above him but cannot defend himself from attack beneath. In a biplane, the wings are less in his way and he can see below and to the rear, as well as above, and is only hindered in his vision by the narrow lower plane.

To even better this condition, triplanes are being built, as shown in Figure 2, with three planes, one above the other, and one German machine has even four planes. This arrangement allows of very high speed, a narrow span, and yet a high aspect ratio, and even a lighter ratio than can be had in the biplane. Head resistance is a thing to be watched, but the newer triplanes travel in excess of 125 miles an hour.

The vision on a triplane is exceptionally good as the obstructing wings are narrow and hard to hide behind.

One would think from a ground viewpoint that it would be almost impossible for one airplane to hide from another in the air, but it has been found possible to hide behind blind spots of certain planes and attack and bring down the enemy without his even knowing of the other plane being near until the bullets begin to fall.

In most planes of the past year, if the attacking plane could approach from the rear and beneath, he could not be seen on account of the size of the tail structure, and if he had speed enough to catch up, could shoot forward through the tail structure and the back of the seat and hit the pilot with ease.

In order to further increase vision and to slightly diminish the head resistance of struts, many planes set the top plane forward in advance of the lower, giving a stagger to the wings as shown. In some cases, the upper wing is made to two-spar construction and the lower of smaller chord and single spar construction as in the French Nieuport. This greatly increases the vision of the pilot, and also assists in the speed of the plane.

To assist in side stability, that is to keep the plane from upsetting sideways, it is quite usual to slant the wings up on either side from the center a-b in a dihedral angle as shown in Figure 3.

In this construction, if one wing raises higher than the other, the wind begins to slip over the higher wing tip on account of its greater slant, so that this wing lifts less than before. The other wing having dropped, strikes the air at a better angle and lifts more than it did before. Thus the lower wing tends to come up and the other wing to drop, bringing the plane automatically and naturally back to its proper level. If this angle is overdone, however, a pendulum motion is likely to be set up. At any rate, when a dihedral angle is used, it is necessary that a vertical fin be fitted at the rear of the body or extra rudder surface to control the pendulum action of the dihedral.

At (B) in Figure 3 is shown a similar angle in plan view known as sweep-back, intended more or less to counteract the action of the dihedral angle just described, but this construction has not been found as successful in controlling instability as a vertical fin with the rudder at the rear.

The next article will describe the controls of a plane and how they are arranged to enable the pilot to steer in any direction and accomplish those tricks which are demanded by modern war work.

(Photographed by International)

Lieut. Doughlas Campbell who has been decorated with the French War Cross for his part in the capture of two German airplanes. Lieut. Campbell and Lieut. Allan S. Winslow, of Chicago, engaged the enemy planes and downed both of them after a short fight. The enemy aviators were made prisoners. Lieut. Campbell is a native of California and a graduate of Harvard

Putting Wings on the Postage Stamp

The first plane to make the aerial mail trip from New York to Washington leaving Hempstead Field. Lieutenant T. H. Webb is the pilot and he is flying an army plane

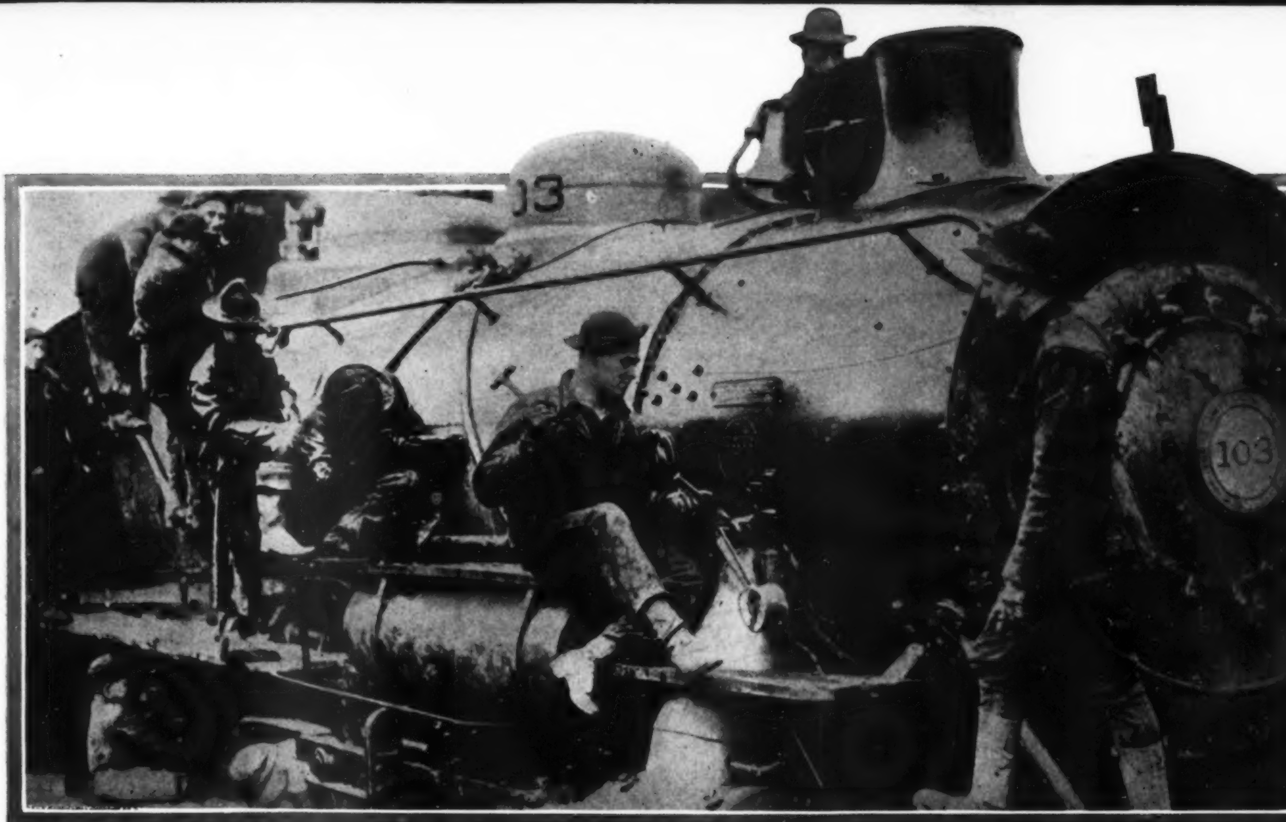
Lieutenant Culver, who started from Washington in the first aerial mail flight, arriving at New York, leaving the national capital at 11:30 A.M. and arriving at Hempstead at 4:30 P.M

Photographs Copyrighted by Underwood & Underwood

Photograph Copyrighted by International Film Service

President and Mrs. Wilson witnessed the start of the first airplane mail carrier which started from Washington. Postmaster General Burleson, together with President and Mrs. Wilson, made an inspection of the machine

Lieutenant T. H. Webb is seated in his army airplane, ready to start on the first mail-carrying flight between New York City and Washington. It is planned for one plane a day to leave each city with its load of mail pouches

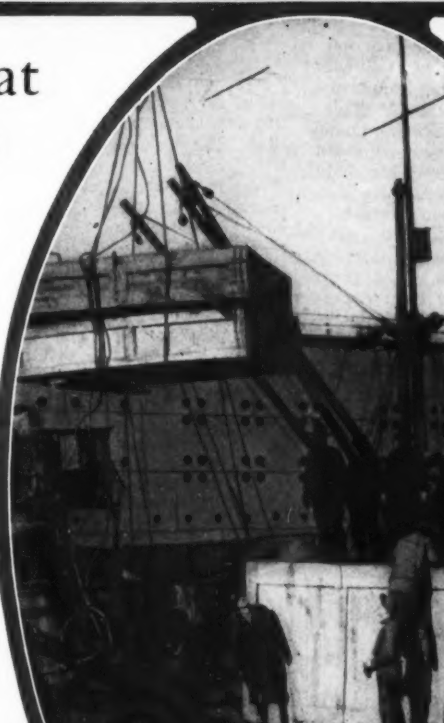


A locomotive being assembled by the American Railway Engineers in France. It was built in America and shipped "knocked down" to France

All France Wonders at American Engineers

By Francis A. Collins

Author of The Fighting Engineers, Etc.



Hoisting an American built locomotive aboard a liner at an Atlantic port

Photographs by Committee on Public Information.

SO high an authority as Marshal Joffre has called the present struggle "a railway war." For many years Germany has maintained four-track railroads for strategic purposes to the French and Belgian frontiers when two tracks would have carried the peace traffic. The extra tracks were overgrown with grass, but were kept in order with an eye to future war business. Over these lines were carried the German troops and supplies which overwhelmed Belgium and northern France. It was due on the other hand to the efficiency of French railroads that her army could be rushed to the front, and the enormous quantities of supplies and ammunition to hold the line firm.

No assistance which America lends to France in her hour of need is so helpful as the work of our engineers, backed by unlimited resources. Tens of thousands of expert railroad men are already in France. The best engineering skill of the United States is enlisted in the work. A peace-loving people is naturally slow in assembling and drilling a great army, but the call for help found our engineers fully prepared. The achievements of our railroad regiments has made a very favorable impression upon France and England. The enthusiasm and skill of our engineers may well be a source of national pride.

Before the beginning of 1918 American railroad men had completed more than 800 miles of standard gauge tracks in northern France. The tracks and equipment for this great task came from the United States, as did every workman engaged in the enterprise. No detail of the American equipment has so impressed the French as the great locomotives from oversea, which completely dwarf the European engines. Upwards of 2,000 American locomotives of the most approved types will be sent to France, and several hundred are now in active operation. The American box car, with more than twice the capacity of the French car, has besides greatly increased railroad facilities over there. More than 20,000 such cars will be used in France. They are built in the United States, knocked-down, shipped abroad and reassembled with surprising speed.

Despite the speed with which this work is being carried on its quality is as high as the best railroad construction at home. The American Director General of Transportation, W. W. Atterbury, formerly vice-president of the Pennsylvania Railroad, stated recently that this construction would enable us to fight a thirty years' war, were it necessary. The great burden on the French railroads is the transportation of troops and supplies from the seaports to the front. American engineers have laid out complete systems of tracks with spurs, sidings, branch lines and freight yards to gain the highest possible efficiency in this work.

The first American railroad men to reach France encountered unheard of difficulties. All French construction is in the metric system, the signal system in reversed, thousands of details of construction and operation must be learned before the Americans could take over the foreign machinery, and operate it. Within a few weeks, however, the Americans had mastered these details. Hundreds of miles of French lines were double tracked. Our engineers laid out whole systems of railroads, making the preliminary surveys, bridging valleys and tunneling under other tracks, all with a speed which astounded the French

Photographs Copyrighted by Western Newspaper Union.

Canadian soldiers rebuilding a railway through a trench town which has been destroyed by shell-fire

and the British engineers. It is a great proof of the confidence with which the French regard our railroad men that they were entrusted with the management of entire railroad systems. Many interesting letters have been received from our men over there describing their experiences under strange conditions. The Americans found the French tracks full of curves and the grades very heavy compared with conditions at home. The French freight engines had no compressed air and no sand, which made it difficult to hold the trains on down grades. The cars are connected by link couplings and bumpers which have been abandoned in the United States. The French freight car is so light that it is often pushed by hand to the sidings. The great forty-foot freight cars imported from America, operated by American locomotives is increasing the carrying capacity of the roads upon which so much now depends.

When the history of the great war comes to be written the railroad engineers will doubtless hold a high place. The first American railroad regiment, consisting of 1,100 experienced engineers and trained railroad workers, reached France only three months after war was declared. They carried with them an immense quantity of tools and supplies and were hard at work a few hours after their arrival. They were soon followed by two regiments, each comprising 1,587 men, and later by five battalions of 774 each, especially selected to operate French railroads. It is estimated that there are more than 100,000 skilled engineers and workmen either in France today or training for the work. A few weeks' drill in the camps fits these engineers and workmen for efficient service in France.

One of the greatest achievements of the railroad regiments abroad has been the construction of the immense supply yards and depots at the French ports for receiving and handling efficiently the American troops and their supplies. Some of the ports of entry are tidal harbors, and it has been necessary to design great basins for the ships that the cargoes might be transferred to the railroads as quickly as possible. The docks for handling vast supplies as well have been designed in America, and the necessary material prepared and shipped over seas and reassembled. Miles of railroad tracks have been laid on these wharves, and the best railroad talent of the United States is employed in organizing the work of handling cargoes and rushing them to the front. If the enemy is to be held, it is imperative that the vast stream of supplies and ammunition flow steadily forward without interruption.

The American railroad engineers have solved many new problems abroad, receiving the highest praise from the military authorities. The speed with which they have constructed railroad lines has established new records in France at least if not in the world. At one point a stretch of track five-eights of a mile long was laid in 2 hours and 10 minutes. Until the coming of the Americans it was found impossible to lay tracks in certain sections of Flanders where the ground was partially under water. The weight of the tracks carried them in a few hours below the waterline. The American railroad men, however, built a line of track in this section which stood the test. Their work has been highly praised by General Haig. Our men have built many miles of light, narrow gauge roads near the front, often working under fire.

As might be expected our railroad men, although untrained as soldiers, have given an excellent account of themselves in the face of danger. As a hospital train approached a casuality clearing station one day a German battery, despite the white flag, deliberately shelled it. It seemed impossible that the train could pass through this direct fire, but the engineer, without a moment's hesitation, drove full-speed ahead through the danger zone and remained under fire while hundreds of helpless wounded were assisted.

Many stories are told of daring engineers and their crews who have stuck to their posts with the bullets raining about them, while their trains have been loaded. Dur-

(*Continued on page* 88)

Pushing a railroad through captured territory on Vimy Ridge

Looking Beyond the Limits of the Universe

One Hundred Million New Stars Added to the Map of the Heavens by a New Telescope at Mount Wilson Observatory

WITH the installation of the great reflector at the Mount Wilson Observatory a new window is opened on the mysteries of space. It is now possible for the first time to look upon unknown regions of the heavens never before observed by man. So great is the power of this instrument that it enables the astronomer to penetrate beyond the limits of the universe, as it is commonly bounded. In the early days of astronomy the discovery of a new star was announced as an event of importance. The great reflector reveals 100,000,000 new stars which have heretofore been invisible to the most powerful telescope.

The marvelous magnifying power of the great telescope is due to the giant reflector, measuring 100 inches in diameter, which has just been successfully installed. The reflector previously used in the observatory measures 60 inches in diameter. The new glass, which weighs four and one-half tons, is one of the great achievements of the lens maker's art. Although more than 8 feet in diameter, its surface does not vary as much as one-thousandth of an inch from the required measurement. Incidentally it reveals stars two and a half times fainter than any now visible.

An order for the giant glass disk was given to a French firm in 1906. The melting pot used in casting it had to hold twenty tons of molten glass. Great difficulty was experienced in casting an absolutely flawless piece. It was not until 1909 that the glass finally reached California. The grinding was commenced in the following year. The first disk was found to have a slight flaw and had to be recast. The preparation of the mirror was carried on under the direction of Prof. G. W. Ritchey, of the Mount Wilson Observatory staff, and has required years to complete. The finished glass measures 12¾ inches in thickness, the depth of its curve being 1¼ inches.

This reflector acts as the support for a coating of silver and is therefore the largest and most perfect mirror ever constructed. To keep it in perfect condition, it is necessary to recoat the glass twice every year. A special track with an apparatus for handling the glass have been installed in the observatory for transferring the reflector to a special room where it is resilvered. So delicate are the observations carried on with the great reflector that even a microscopic flaw would render the observations useless.

The observatory on Mount Wilson stands at an elevation of 5,700 feet above the sea and great difficulty was encountered in transporting the 4½-ton reflector up the winding mountain roads. After wrapping the glass with the most anxious care it was mounted on a motor truck and the journey up the mountain commenced. During the journey the motor truck broke down under the strain, and a wheel came off, but the glass was uninjured. The accompanying illustration was taken when the truck carrying the reflector finally reached the summit of the mountain. The great size of the dome of the observatory is clearly shown.

Few people realize how marvelous an observatory has been erected on this mountain top to the credit of American science. The impressive white dome rests on a concrete base. Great care has been taken to provide an absolutely stable foundation, since the slightest vibration would make many observations impossible. The dome, which measures 100 feet in diameter, weighs 500 tons. The observatory rests upon rails controlled by delicate machinery and may be swung about by merely touching a button without the slightest noise or vibration. The opening through which the telescope points can therefore be quickly adjusted to command any part of the heavens.

The immense tube of the telescope is a marvel of ingenuity. It is held in position by steel drums filled with mercury which weigh 700 pounds. The telescope may be turned in a shaft 17 feet in diameter with a touch of a finger. This movement may be controlled by clock work, so that the telescope will turn automatically at any desired rate. It can be set, for instance, to move in exact time with the rotation of the earth, so that the observer can watch a star for hours without touching the instrument. Without this arrangement the star would soon pass from the range of vision, and the telescope would have to be constantly readjusted.

In making observations the astronomer does not look directly at the sky. The light does not penetrate the mirror, but is reflected to a second mirror from which it is reflected to the camera or the eye of the observer. It is estimated that there are about 5,000 stars visible to the naked eye. According to the calculation of Chapman and Melotte there are some 219,000,000 stars brighter than the twentieth magnitude which are within range of the 5-foot or 60-inch reflectors. The new reflector, it is believed, will add 100,000,000 new stars to the maps of the heavens. Many secrets of the heavens which have puzzled the astronomers will be revealed by the new glass. It will explain for instance the spiral nebulae, and especially the small nebulae which have heretofore baffled the men of science. Many unknown regions of space will now be looked upon for the first time by the eyes of man. The term universe has commonly been used to describe the furthest conceivable realms of space. Astronomers have learned, however, to measure the limits of our universe, measuring it by light years, or the distance which light will travel in one year. To measure these distances by miles would convey no idea to the mind. With the new reflector it will be possible to penetrate even beyond this universe.

It is planned to remap the heavens by means of photographs with the aid of the new reflector, which will be the labor of years. The eclipses and other phenomena of our period will also be photographed by moving picture process.

The reflector for the new telescope being delivered at Mount Wilson Observatory. The reflector was built in France and took twelve years to construct

Creating Life Artificially

Experiments Being Carried on by Which Life-Forms Are Duplicated with Startling Accuracy

By Hereward Carrington

THE artificial creation of life has been the dream of the experimental biologist for many centuries, and the alchemists devoted a large share of their activities to experiments of this character. The controversy waxed hot during the last century; but, some years ago, the problem was all but given up as insoluble. The recent startling experiments of Bastian, Butler Burke, Le Dantec, Le Duc, Loeb, and others, however, have again opened up a wide field for inquiry and speculation; and today there is a large and constantly increasing number of scientists who believe that this problem will yet be solved, and that we are even now on the verge of tremendous discoveries, which will throw an entirely new light upon this whole subject, and enable us to create life, or at least duplicate many of its manifestations, almost at will.

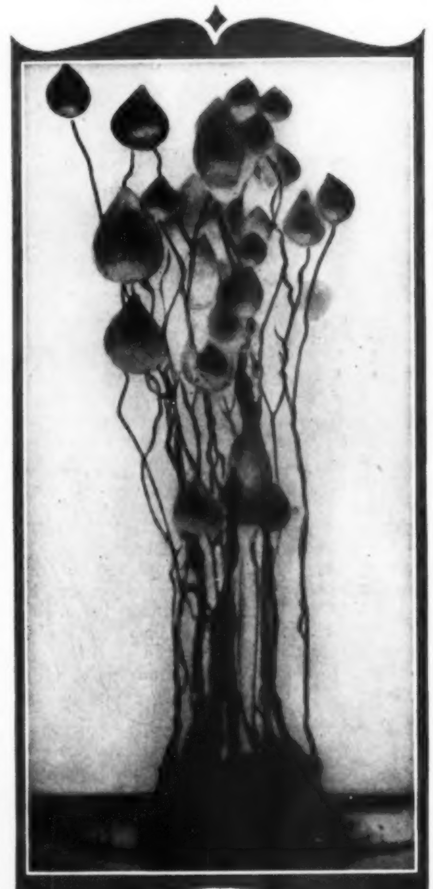
The latest and most startling experiments of this kind are those conducted by Dr. Stéphane Le Duc, Professor of Medicine in the College of Nantes, France. He has published a number of important monographs in French, during the last ten or twelve years, and his latest one, *The Mechanism of Life*, summarizes his most recent, striking researches, and his conclusions, and it is with these that the present paper will chiefly deal. Before doing so, however, a few words must be said regarding the general problem of the nature or origin of life on this our world, and the previous methods by which this problem had been approached.

Two things are certain. The first is that life cannot always have existed on our earth, for it was too hot to permit it. The second is that, sometime in the future, life will again become extinct upon its surface, owing to the intense and gradually increasing cold. Humanity will be frozen out. And, before that happens, the then-existing humanity will be called upon to wage the most terrible and hopeless war it has ever waged against cold which is constantly increasing, and which only the originality and resourcefulness of man can succeed in postponing. Life is only possible between the freezing and the boiling points of water; so that, during the process of the cooling of our planet, from an incandescent state—several thousand degrees—to absolute zero (—273°C.), life appears but a very short time indeed, comparatively; it is, as one savant has expressed it, "but a flash in the pan, between two eternities of darkness." Yet it is this flash which is everything!

Granting, then, that life cannot always have existed upon our planet, and accepting the very obvious fact that it exists here now, the question naturally arises: How did it get here? How came life into being? That is the problem of the origin of life.

Materialistic and monistic scientists generally believe in spontaneous generation—in the theory that life somehow gradually evolved or grew into being from the inorganic world. This view has been bitterly attacked by the Vitalists and the Theologians, who see in life something living or divine—an essence, a "Breath of God," or what not, apart from matter. To this view, very naturally, the scientist has objected. Others have attempted to account for life by supposing that it was carried to this earth on tiny particles of dust, propelled through space by the light energy of the sun—Professor Arrhenius being the latest exponent of this view. But this obviously leaves us at as great a loss as ever to account for life upon the planet from which these life-germs were carried, and hence we are no forrader than before.

Figure 4. A cluster of chemically created flowers of varying tints



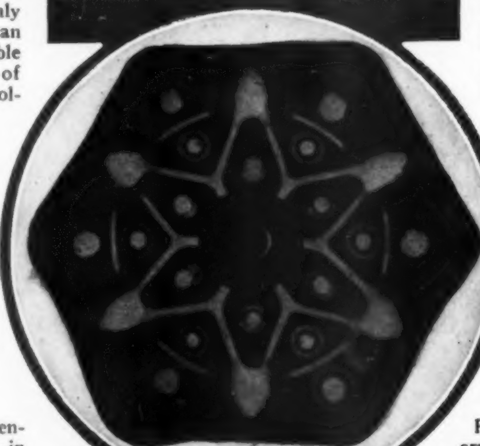


Figure 1. Artificial duplication of crystal by means of diffusion of silver nitrate and sodium carbonate in gelatine

Apart from transcendental theories, then, there is only one which we can accept, *viz.*: that life somehow sprang into being in this planet, and this conviction gave rise to the recent outburst of experimenting on the part of certain biologists.

Professor Loeb, as we well know, succeeded in fertilizing the eggs of sea-urchins—thus proving that, in this case at least, chemical, and not vital, factors were instrumental in producing the new-born. Professor Butler Burke, of Cambridge, experimented upon radium and sterilized bouillon, producing bodies he called "radiobes." Dr. Le Dantec has labored persistently to prove the similarity between living and non-living substances, and Dr. Charlton Bastian has apparently succeeded in creating actual, living things in test-tubes, by means of chemicals and sterilized water. One of his formulæ, for instance, is the following: In a sterilized test-tube place—

Sodium silicate, two, or three drops.
Ammonium phosphate, four, or six grains.
Dilute phosphoric acid, four, or six drops.
Distilled water, one fluid ounce.

This mixture was placed in a test-tube, brought to the boiling point, and hermetically sealed when boiling. It was then placed in an oil bath of about 360° F. (far above boiling point), and kept there from ten to twenty minutes. The tube was then taken out, set aside, and, upon examination, in a few days, was found to contain numbers of bacilli. These striking experiments have never been fully explained.

The later experimenters, however, have approached the problem from a different angle. Instead of attempting to create these relatively highly-developed forms of life, where heredity and other factors might be supposed to play a part, they have attempted, merely, to duplicate the lower forms of life, in their method of growth and living, and thus demonstrate the close analogy, or indeed identity, between the living and

Figure 2. Shells created by osmotic pressure

Figure 3. Chemically produced mushrooms

Figure 6. A garden of artificially created flowers which strikingly brings home to us the very close resemblance between the real and artificial growths—between the living and the non-living

the non-living in their methods of growth, nutrition, structure, etc. This is the line of attack followed by Dr. Le Duc, with eminently striking and successful results.

What are the characteristics of life? When we come to inquire into them, we find that the differences between the living and non-living, as we have been accustomed to call them, are not so striking or so numerous as we had supposed: that, indeed, it becomes extremely difficult to draw any hard-and-fast line between them. They often merge into one another so intimately that distinction is impossible.

Movement is not characteristic of life; for everything in nature is now known to be in constant movement. Sensibility and irritability have been shown to be present in metals as much as in plants and animals. Action and reaction are found throughout nature. Growth and nutrition, in various forms, are seen in crystals and in certain artificial growths; continuity, harmony, life and death are seen throughout the whole realm of nature. The recent experiments in so-called osmotic growths have brought these facts out more clearly than ever before, and seem to show us that all Nature is a continuity—an unbroken chain, constantly evolving, and living upon lower planes of matter than itself—as the vegetable seems to live upon and organize the minerals upon which it subsists, building them into its own structure.

Life has lately been defined as "the sum of all phenomena exhibited by living beings," which is merely defining a living being. A living being, again, is "a transformer of energy and of matter, containing certain albuminoid substances, with an evolutionary form, the constitution of which is essentially liquid." When this works in harmony, we have life, this harmony we call life. Discord is disease, the total cessation of the harmony is death. Life in living beings is potential, in their processes of living it becomes actual or kinetic.

Living matter is composed of a variety of chemical elements, all of which are well known to us, though their complex combinations are not so known in many instances. Life grows and manifests under certain fixed conditions of gravitation, heat, light, temperature, electrical, and chemical affinity, etc., and hence all structures, formed or artificially created, must bear some relation to one another. Oxygen and carbon are perhaps the most essential ingredients in all living forms. Water or fluidity, is essential. The human body is composed of about three-fourths water, and all vital phenomena occur in liquids or semi-liquids. Accordingly, a study of liquids, or solutions, is one of the most essential and important matters in connection with the study of life phenomena.

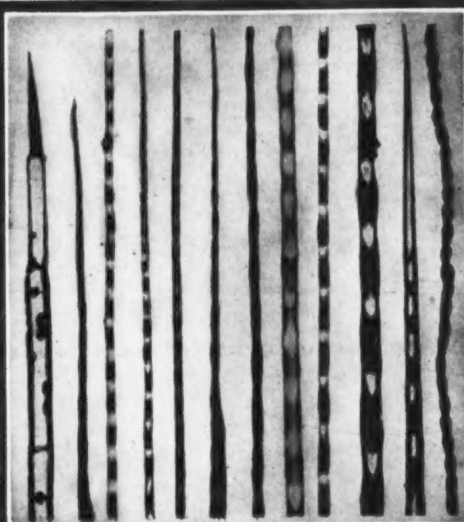


Figure 5. Enlarged view of the stems of flowers in Figure 4, showing the resemblance of these chemically created plants to the bamboo in their method of growth

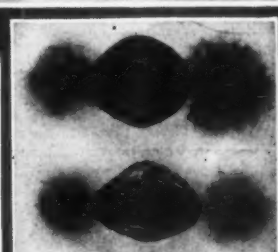


Figure 7. Showing the division and multiplication of a cell by chemical diffusion, closely duplicating Nature's method of reproduction

A "solute" is a substance capable of solution. A solution is a homogeneous mixture of one or more solutes in a liquid solvent. Before solution, the solute or dissolved substance may be liquid, solid or gaseous.

Now, this solution tends to expand in all directions, in proportion to its density or concentration. It exerts a definite pressure on the vessel holding it, and this pressure is known as osmotic pressure. The osmotic pressure of a solution is the force with which the molecules of the solute, like gaseous molecules, strive to diffuse into space, and press on the limits which confine them, the containing vessel being represented by the surfaces of the solution. Osmotic pressure is measured in exactly the same way as gaseous pressure. So true is this, and so significant is it of all life phenomena, that it has been said that: "the phenomena of life are governed by the laws of gaseous pressure, since all these phenomena (of life) take place in solutions."

All this may sound very abstruse, and beside the point; but it is not so in reality, for these new experiments in the artificial duplication of life-phenomena have all been based upon the principles just laid down, and upon a study of osmotic pressure. As a result of this, and its proper utilization, what are known as osmotic growths take place, and it is these osmotic growths which we are now to study, and it is these which are shown in the various illustrations accompanying this article.

We have spoken of "osmosis." Just what is osmosis? In 1748, l'Abbé Nollet discovered that when a pig's bladder filled with alcohol was plunged into water, the water passed into the bladder more rapidly than the alcohol passed out; the bladder became distended, the internal pressure increased, and the liquid spurted out when pricked by a pin. This passage of certain substances in solution through a membrane is called osmosis, and membranes which exhibit this property are called osmotic membranes. Differences in the pressure of the two solutions causes this osmosis. On the other hand, the process by which a substance (such as a lump of sugar) becomes equally distributed throughout a fluid in which it is placed (such as a cup of coffee) is called diffusion. These two processes are fundamental in all life phenomena.

Let us take some examples. It has often been pointed out that crystals bear very beautiful geometrical shapes; yet these same forms can be artificially duplicated by means of dif-

(*Continued on page 60*)

Chaco with 300 H. P.

A 60-Foot Express Cruiser Powered with Sterling Motors Recently Completed on the Great Lakes

ONE of the first boats of its type on the Great Lakes is Chaco, designed and built by the Matthews Boat Co., of Port Clinton, O., a 60-footer with a beam of 10 feet 6 inches and used by her owner, Peter G. Thompson, Jr., for making frequent runs between Sandusky, Cleveland, Toledo, and his summer home at Charlevoix, Mich.

In appearance Chaco is somewhat on the destroyer type, with high forecastle followed by a deck house and a trunk cabin. The interior is arranged with accommodations for a crew of two forward under the raised deck. The floor of the deck house is a little below the level of the main deck to provide full headroom without having too high a structure above deck. The space below the floor is taken up by four gasoline tanks, two of 130 gallons and two of 187 gallons capacity.

The power plant consisting of two eight-cylinder Model F Sterling motors that develop 300 h.p. and give Chaco a speed of 24 m.p.h., is located in the trunk cabin directly aft of the deck house. Ample ventilation of the engine-room is assured by two large size cowl ventilators, and a good sized stack. The fresh air is taken in through the cowls while the heated air escapes through the stack.

The space under the deck at each side of the trunk cabin is taken up with a gasoline tank having a capacity of forty-one gallons each.

The main cabin and galley are housed in the trunk cabin extending from the engine-room to the after deck. The galley with its stove, sink, dish racks, cupboards, and ample size ice-box is on the starboard side with the toilet on the port side of the forward end of the main cabin.

On each side of the main cabin there is a large size wardrobe and a folding double berth. Across the after end is a single berth, while a buffet is built in at the forward end. A companionway leads to the after deck.

The space under the after deck is taken up by the two 66-gallon gasoline tanks, and a 174 gallon fresh water tank. The total capacity of the eight gasoline tanks is 848 gallons, which is sufficient for a run of about 500 miles at full speed.

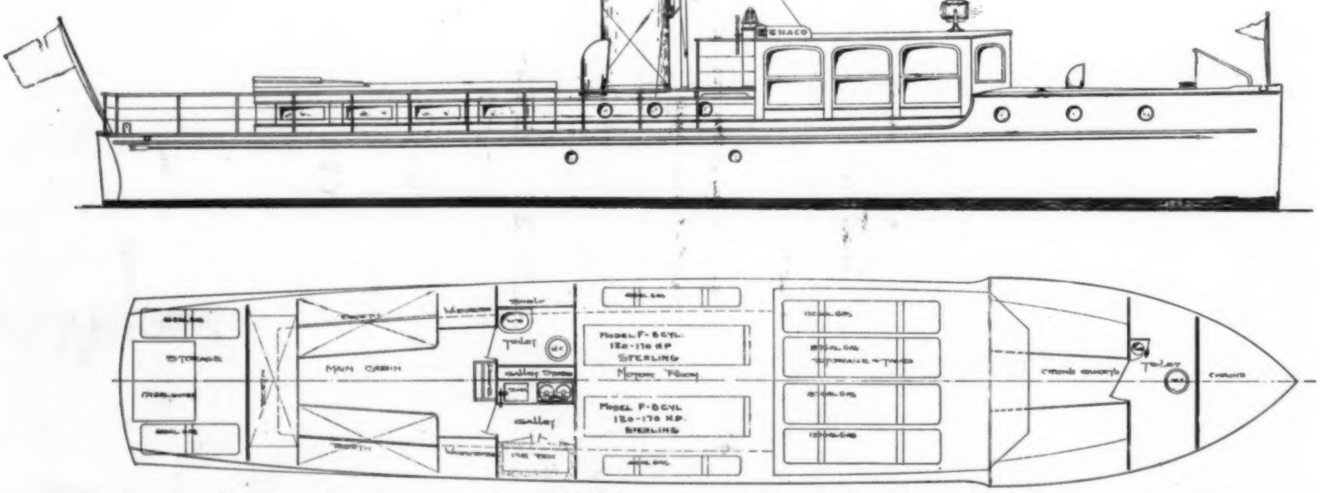
Chaco is navigated from the small bridge located aft of the deck house and directly over the engine-room. The motor controls, steering wheel, binnacle and chart case are all within convenient distance of the man at the wheel, while a powerful searchlight with extension controls is mounted on the forward end of the cabin roof where it will give the best results for night sailing.

The decks and equipment have been arranged for quick and convenient handling. Two anchors are carried in chocks forward ready for use, and a power windlass for handling them is mounted directly over the chain locker, while an anchor davit is provided for getting them on deck without marring the sides.

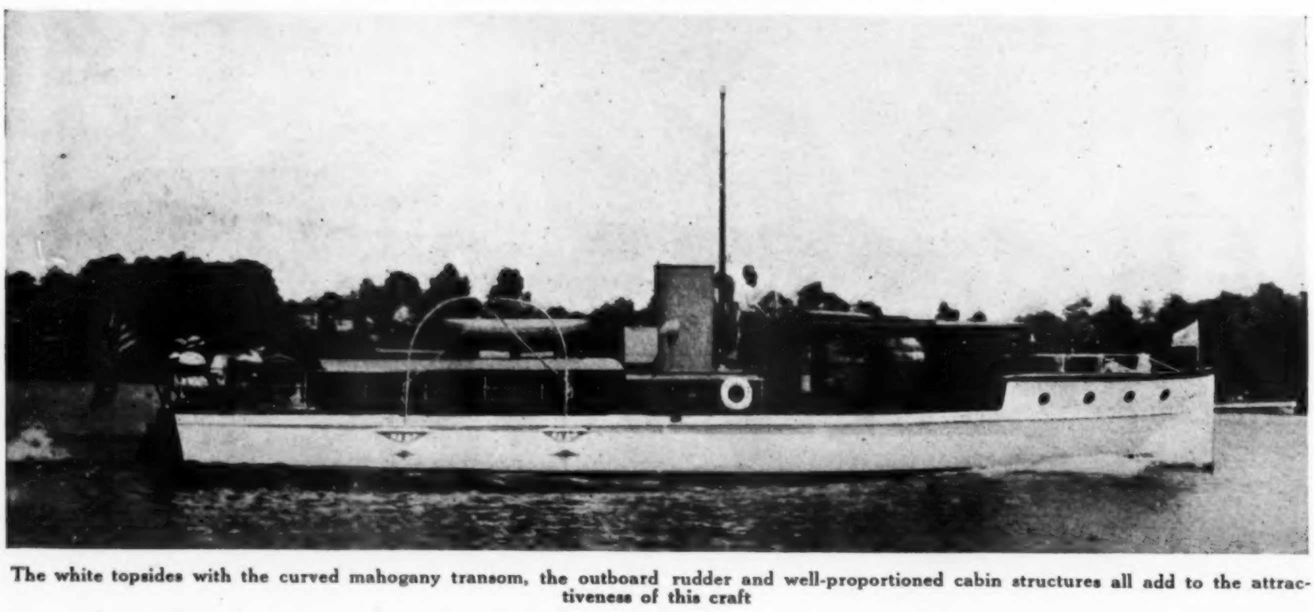
A military mast is located just ahead of the stack, and carries a masthead light, and the usual halyards for signal flags. A small tender is carried in chocks on the roof of the after cabin, and a pair of davits mounted on brackets take care of keeping the tender clear of the sides.

Chaco is of heavy, substantial construction throughout but with the carefully designed underbody lines is easily driven at high speeds. The finish of the boat both inside and out is white with mahogany trim.

Although not intended or equipped for extended cruising this boat, with a speed of over 20 m.p.h., and capable of runs of nearly 500 miles between stops for fuel, should prove a most comfortable craft for a large party on a day's sail or for a small number of guests on a week-end cruise. The deck house forward is much appreciated by the guests.



Arrangement plan and outboard profile. The straight shear line together with the high forecastle, deck house, and trunk cabin makes a very pleasing appearance

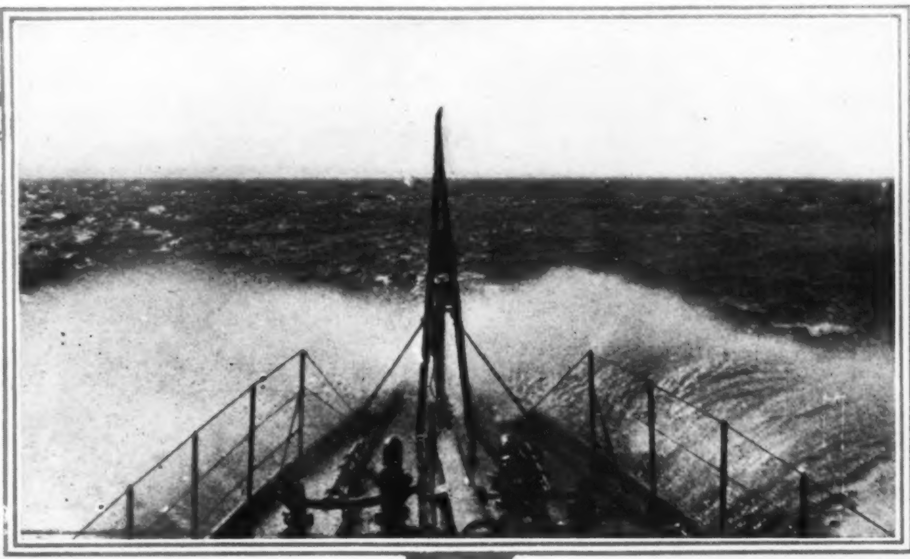


The white topsides with the curved mahogany transom, the outboard rudder and well-proportioned cabin structures all add to the attractiveness of this craft

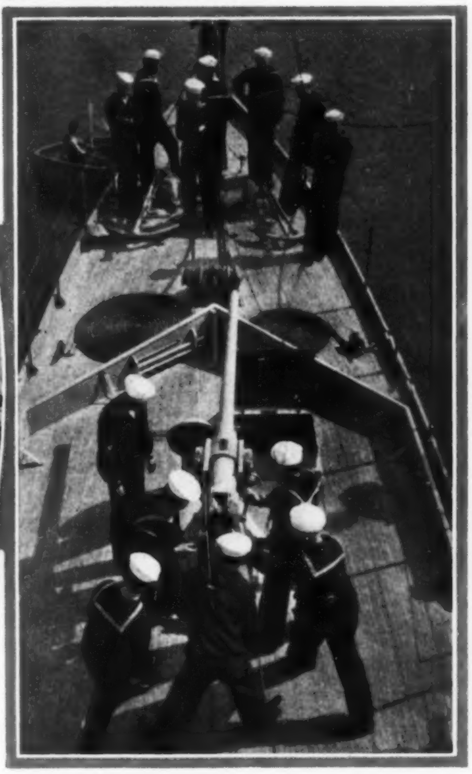
With the 110's Over Here and Over There

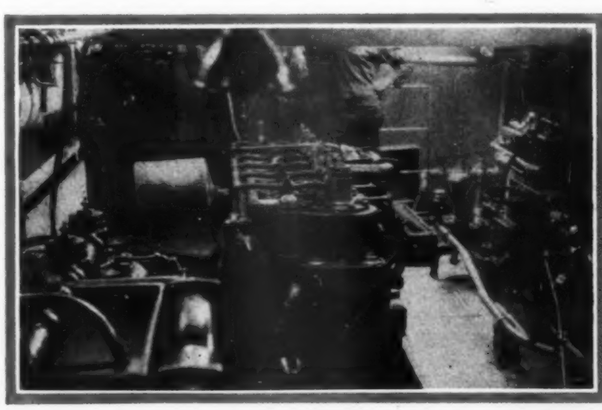
(From photographs submitted by Motor Boating readers)

On this page will be found illustrations typifying various phases of life aboard our fleet of motor boat chasers in actual service. Much of this work is now being performed by former Motor Boating readers. The success of the motor boat as a weapon of war is no longer in doubt



Reports from some of the crews on the 110's both on this side of the Atlantic as well as those who have gone across praise the sea-going qualities of these boats in no uncertain tones. The Navy Department is decidedly pleased with the boats, their power plants, and their crews



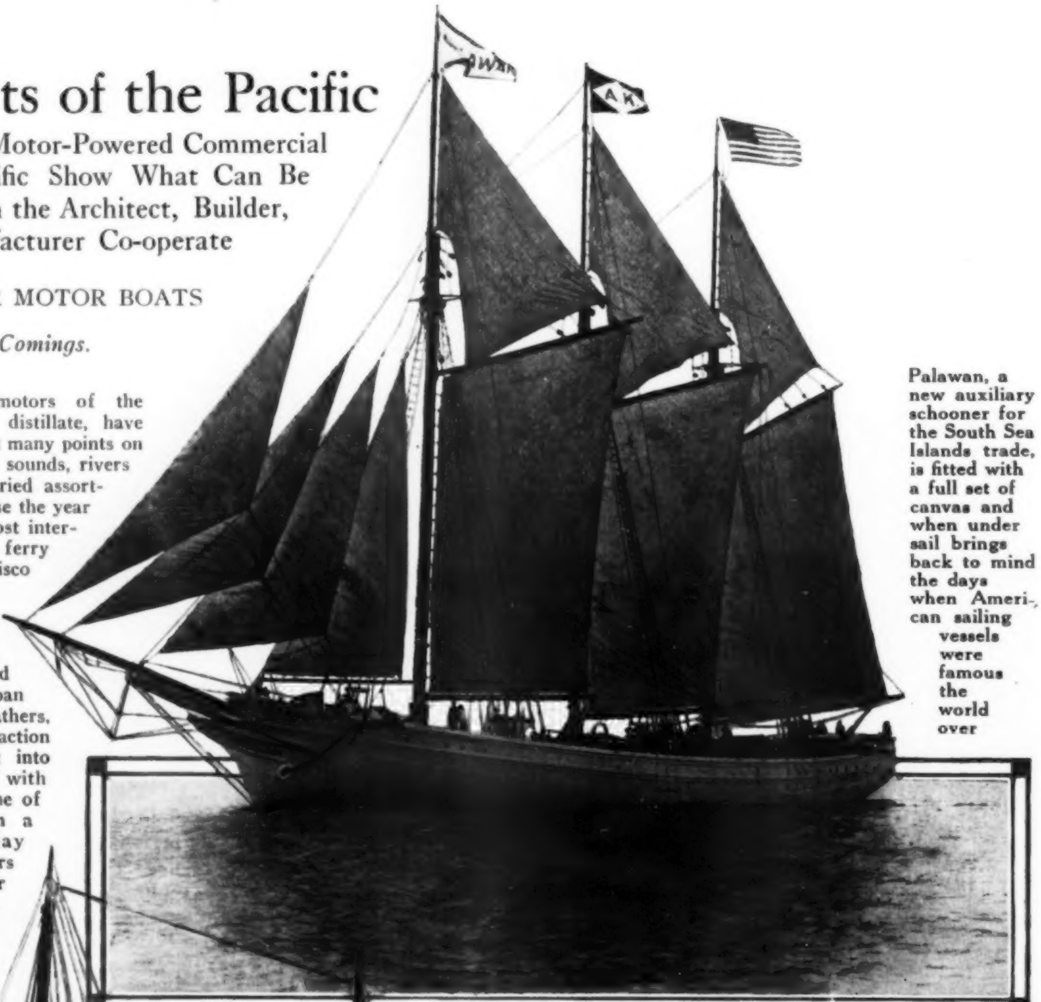


Motor Boats of the Pacific

The Present Day Motor-Powered Commercial Boats of the Pacific Show What Can Be Accomplished When the Architect, Builder, and Motor Manufacturer Co-operate

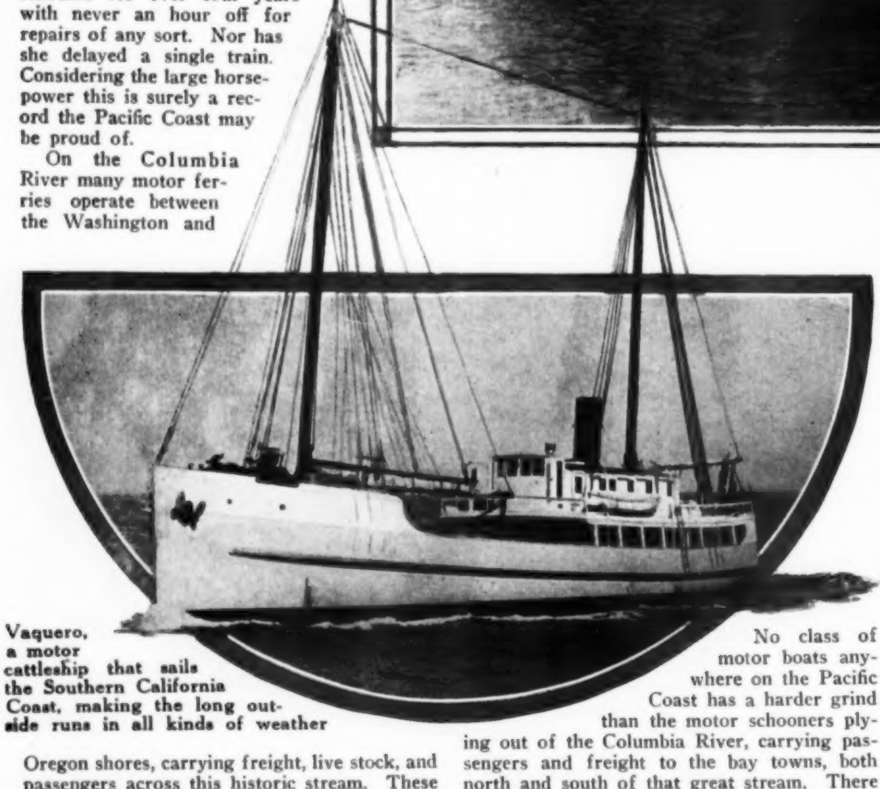
III—THE LARGER MOTOR BOATS

By A. V. Comings.



Palawan, a new auxiliary schooner for the South Sea Islands trade, is fitted with a full set of canvas and when under sail brings back to mind the days when American sailing vessels were famous the world over

INTERNAL combustion motors of the heavy-duty type, burning distillate, have solved the ferry problem at many points on the Pacific Coast, and on the sounds, rivers and bays will be found a varied assortment of this type of boat in use the year 'round. In many ways the most interesting of these is the motor ferry Ramon, used on San Francisco Bay to transport electric trains of the Oakland, Antioch & Eastern Railway Company. This immense ferry carries three full-sized electric cars of the interurban type at one time, in all weathers, and has given splendid satisfaction from the day it first went into service. Ramon is powered with an eight-cylinder Union engine of 600 h.p., and has been on a twenty-four-hour per day schedule for over four years with never an hour off for repairs of any sort. Nor has she delayed a single train. Considering the large horsepower this is surely a record the Pacific Coast may be proud of.



Vaquero, a motor cattleship that sails the Southern California Coast, making the long outside runs in all kinds of weather

On the Columbia River many motor ferries operate between the Washington and Oregon shores, carrying freight, live stock, and passengers across this historic stream. These are mostly of the scow type, with stern-wheel drive. They make their landings, as a rule, directly on the banks of the stream, letting down a hinged gangway for the use of passengers, teams, etc. They are ungainly craft, it is true, but they transport almost unbelievable loads at a very small expense.

On Vancouver Bay, in British Columbia, are several passenger ferries of excellent design, fitted with Corliss engines, carrying passengers between Vancouver and North Vancouver, and these craft run the year 'round without interruption.

At Los Angeles Harbor the famous ferry Transit, with a heavy-duty Imperial engine in her motor room, has been in service many years with unvarying success.

No class of motor boats anywhere on the Pacific Coast has a harder grind than the motor schooners plying out of the Columbia River, carrying passengers and freight to the bay towns, both north and south of that great stream. There is treachery and death in every foot of the North Pacific Coast, yet these little motor schooners go blithely forth from Astoria year in and year out, and the narrow escape they have crossing the bars of every port of call they make is all in the day's work to their fearless masters. It is seldom indeed that a bar is breaking too badly for these schooners to go in or out, and they are tossed about like chips in the process. Were their motors unreliable there would be frequent losses of these little ships, but the heavy-duty motors keep right on working even though the ship beneath them is bucking like a broncho with a burr under its saddle.

These motor schooners are practically all of the same type, and a description of one fits, in a general way, all. The schooner Patsy, for instance, is 101 feet long, with beam of 24 feet, and her construction follows in a general way the same design that has made Pacific Coast steam schooners well known wherever marine talk is heard. Raised decks forward and aft, with a well deck and big holds amidships, these motor schooners are built of the heaviest timbers, fastened in the most secure manner, and they stand terrific buffeting without suffering.

The passengers and ship's officers are quartered in the deck house aft, with the engine-room below them. The wheel-house occupies the forward end of this deck house.

Patsy is fitted with twin Frisco Standard engines of 110 h.p. each, and makes about 11 knots. A 10 h.p. motor of the same make handles the pumps and lighting plant, and her hoisting gear, and for ground tackle and cargo landing there is a 16 h.p. Frisco Standard engine installed.

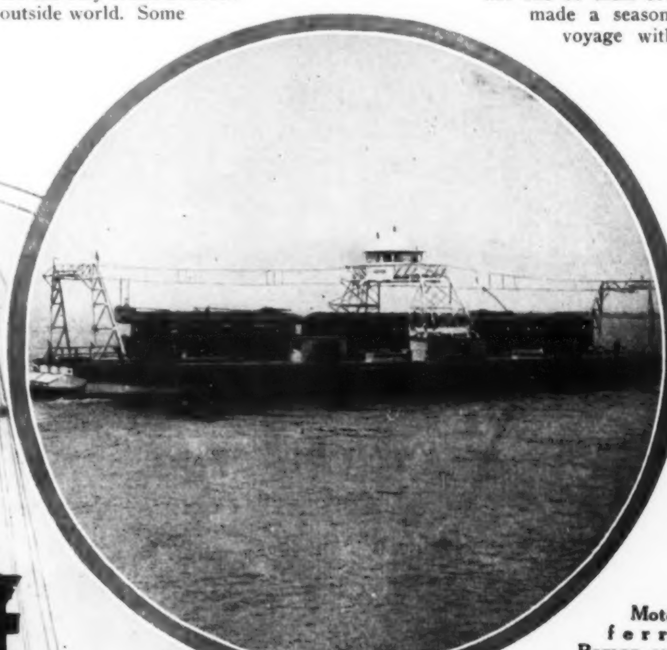
Not only do these motor schooners work south from the Columbia to the larger cities of the Oregon and Northern California Coast, and north of the river into Grays Harbor and Willapa Bay, but the smaller craft even work farther north, carrying passengers and supplies to Tahola, on the Queniult Indian reservation, to Hoh, on the Hoh River, and to Mora, on the Quillayute. All these ports of call are guarded by a ragged, rocky coast with mighty shallow channels into the safer inner waters, and are exposed to the full sweep of the Pacific. Yet these places have practically no communication inland, for they are backed by almost inaccessible mountains, and the little gas boats are often their only means of communication with the outside world for weeks at a time.

Among the best known of the motor schooners working out of the Columbia are Patsy, Mirene, Tillamook, Gerald C, and in years gone by, the ill-fated Oshkosh.

Readers of Robert Louis Stevenson's South Sea Island tales probably believe that only in those far away islands are trading schooners still to be found, but if they will saunter down along the Seattle water front in early spring

they will doubtless find that Alaska and the Siberian Coast have their trading schooners quite as true to the breed as the South Sea Island vessels.

Of these Polar Bear was probably the most famous, though she is now used by the Danish explorer, Stef-fenson, in his arctic peregrinations. Duxbury, P. J. Abler, Helen Johnston, Bender Brothers, and Silver Wave; all were famous in their day, and from Dutch Harbor to Pt. Barrow, from Petropavlovsk even to Wrangell Island, from Nome to the Diomedes, to King Island, to the Pribilofs—everywhere in the wide waste of the Arctic seas, these trading vessels have penetrated, and many a year they were the only touch afforded the natives with the outside world. Some of these have been crushed to kindling wood in the Arctic ice pack, never to return. I believe every one of them has at one time or another been wrecked and salvaged, and I know that not one of them ever made a season's voyage without many hair breadth escapes in storm and ice pack. While differing in many particulars, these Arctic traders are all very staunchly-built auxiliary schooners, fitted with heavy-powered Pacific Coast motors. All carry heavy rigging and working sails of stiffest canvas, but it is their motors that have always brought them through their tightest places, as well as through their longest voyages.

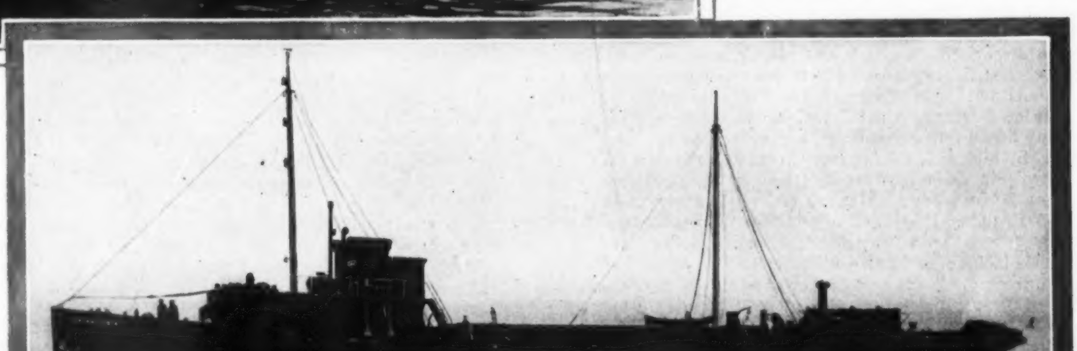


Motor ferry Ramon carrying inter-urban electric cars on San Francisco Bay

Over in the South Seas there are still many trading schooners, but they are no longer the lean, deep, sailing craft that Stevenson wrote of in his stirring tales. Nowadays almost every one is fitted with Pacific Coast made engines, and winds and tidal currents no longer boss them.

Take Palawan, for instance, owned by Atkins, Kroll & Company. This three-masted, double-decked schooner is 176 feet long, having 38 feet beam and draws sixteen feet of water; while she is fitted with full rigging of canvas, still does she rely most on her twin 110 h.p. Union gas engines for propulsion. Each of these motors is of the three-cylinder type, and they

Of the auxiliary schooners trading along the Alaska and Siberian Coast Polar Bear is without doubt the most famous. This is the same sturdy little ship that is now being used by the Arctic explorer, Steffenson, for his work in the Polar seas



Contra Costa a motor-powered oil tanker of the Standard Oil Company that has been in service over twelve years

To the right: Makaala, a motor tugboat working out of Honolulu. This craft is built along the same general lines as those used on Puget Sound, and is often required to make long trips out to sea with heavy, hard pulling tows

Above: Betty Earles, a passenger-boat operating on Lake Crescent in the Olympic mountains. As this boat is used on protected waters, the design varies somewhat from what is considered best practice for ocean-going vessels

give her a cruising speed of over 7 knots in any waters.

Muruwa, a trading schooner that has sister ships in the Motau and Mauno, is a two-masted schooner owned by Burus, Philp & Co., of Sydney, N. S. W., and each of these three schooners is fitted with a 110 h.p. Union gas engine for main power, burning kerosene. These trading vessels are 117 feet in overall length, 27 feet beam and 11 feet draft. They have proved very successful in this service, carrying both passengers and trade.

One of the most interesting fleets of motor craft on the Pacific Coast is maintained by the Standard Oil Company, and is used in distributing Standard Oil products to the hundreds of agencies and marine filling stations from Southern California to British Columbia. This fleet consists of the steel tank ships Benecia, used on San Francisco Bay and its tributaries, Pico, serving at San Pedro, and Petroleum I, Petroleum II, and Contra Costa, used on Puget Sound.

A brief description of Petroleum II will give some idea of the type of motor craft used by the Standard Oil Company in this service. Petroleum II is 118 feet length over all, and has a 20-foot beam. Her oil tanks will carry 60,000 gallons of oil, and in addition she has a large cargo hold forward for case goods, which include cased gasoline, lubricating oils, cup grease, and the many other products marketed by the company. She is built of steel throughout, even to her deck house aft, in which there are liberal accommodations for her officers, and in which also is located the galley, and the pumping room. Her decks accommodate a large number of oil drums, and when Petroleum II starts out on her rounds of the Puget Sound district she carries a really tremendous cargo for such a craft.

I have never been in a more interesting engine-room than that of Petroleum II. She is fitted with a 250 h.p. Union engine, made by the Union Gas Engine Co., of San Francisco, and this motor is well worth knowing. Four cylinders, each having a bore of 15 inches and stroke of 20 inches, are fitted with the now well-known open crosshead type of piston made by the Union Company, which gives access at all times to the wrist pin and its brasses and minimizes side thrust on the cylinder walls. Make and break ignition, of course, and an air starting system that always works.

The crankshaft of this giant engine is 5 inches in diameter, and to it is fitted a four-bladed propeller of 5 feet 6½-inch diameter and 5 feet 5½-inch pitch which the engine turns at from 190 to 200 r.p.m. The engine is approximately 14 feet long and 5 feet wide at the base, and measures 9 feet in height from the engine-room floor to the top of the cylinders. The flywheel weighs two tons and the entire motor about thirty tons. Compare this with the high-speed type of motors rated at 250 h.p. and the comparison will produce some very interesting figures.

This motor, which is practically the same as the two used in the Contra Costa, and as the motor used in the Benecia, has been very successful in day after day service year after year, and I know from personal observation that these boats go up against just about as stiff a schedule as it is possible to hand to a boat of any kind, whether steam or gas.

The Contra Costa, one of the older distributing boats of the S. O. fleet, is 189 feet long, 37 feet beam, 13 feet 6 inches draft. If memory serves me right the Contra Costa has been in service over twelve years, and her motive power is just as good today as the day it was installed. Records such as this certainly show that commercial motor craft are quite as reliable and practical as steam.

In addition to the main power plants, all these Standard Oil boats are fitted with Union-powered pumps, and several with Union-powered hoists for handling ground tackle and cargo.

Miscellaneous local freighting of all sorts is carried on up and down the Pacific Coast from Nome to San Diego, and a varied assortment of big motor vessels is engaged in this work. One of the most interesting is Vaquero, owned by Vail & Co., of Los Angeles, and used for carrying cattle off the Southern California Coast. Vaquero is quite a ship, for she is 130 feet long, 29 feet beam and draws about 10 feet. Powered with a 250 h.p. four-cylinder Union gas engine, she has plugged away for over five years on long, outside runs with practically no repairs or delays of any sort. And it is records such as this that have made Pacific Coast motor craft known the world over.

Chiralite is another Pacific Coast freight and passenger carrier of the most modern type, built in Vancouver, B. C., for the International Petroleum Company, and used off the coast of Peru. Chiralite is a regular ship, 85 feet by 18 feet, with two Model 2 D 70 h.p. Sterling motors in her engine-room. Inasmuch as her initial trip, from builders to owners, was something over 4,200 miles of open sea, it will readily be understood that Chiralite, like all Pacific Coast motor craft, was built to stand the gaff.

One feature of the development of commer-

(*Continued on page* 58)

My Ideal Runabout

No. 5—Goblin, a Twenty-Footer

By C. J. Roese

I BELIEVE the runabout to be the type of motor craft most enjoyed by the greatest number of motor boat enthusiasts. Although a person may be fortunate enough to own a fast cruiser, he will want a small boat, easily managed by himself, in which he can romp around to his heart's content.

Even the autoist must acknowledge that motor boating in its modern sense with its modern conveniences is by far the more enjoyable and healthful sport. With the ease of starting and control of the motor car, the runabout sets off on a road which needs no paving. The highways are free and uncrowded. The only edge of the road is the shore. There are no speed or traffic regulations and no worry about that dangerous grade crossing. The tires need no attention. Their absence eliminates such troubles. The air over the water is never dust laden, but always cool and refreshing. The helmsman is under no such nervous tension as is the auto driver.

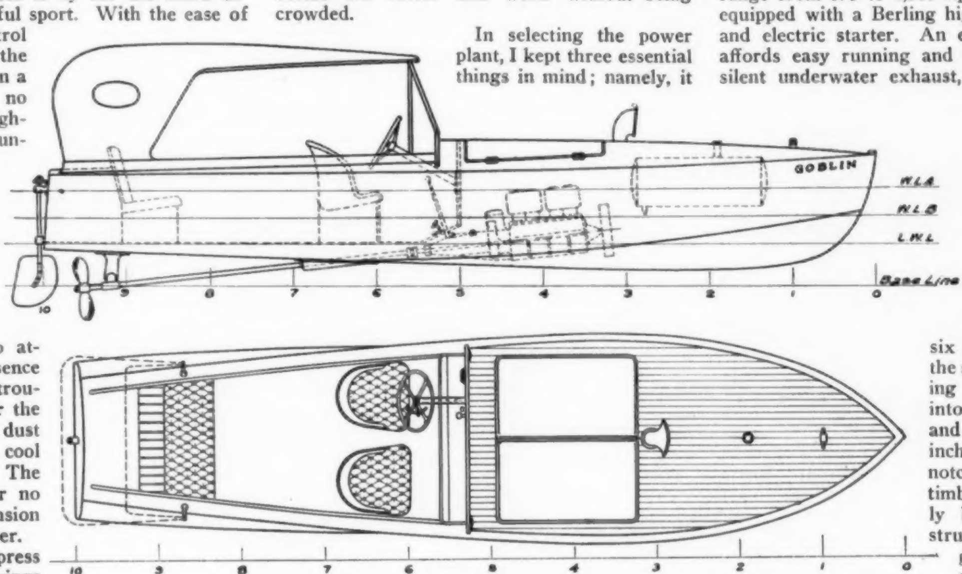
I shall try to express my ideas in drawings and words, of what to my mind is an Ideal Runabout. The boat is especially suited to inland waters and its proportions are such as to make it dry and safe even in rough weather. It is moderate in cost, complete in equipment, and easily managed. Goblin measures 20 feet over all with a 5-foot beam. The frame is of clear grain white oak and the planking is ½-inch Louisiana red cypress. The deck is built of tongued and grooved oak, while the trim is of quartered oak. Inside and outside the finish is natural, having one coat of filler, one of dark oak stain, and three coats of marine varnish rubbed down where desirable.

The deck fittings and all metal trim are of polished nickel. The 6-inch regular pattern cowl supplies ample ventilation for the engine compartment. Considerable thought has been given to this portion of the hull, for there is little pleasure in working on an engine which is not easily accessible. The motor is placed slightly forward. The covers over the compartment are of light sheet steel. The hinges are so made that the pin is tight in one-half of the hinge. When the covers are opened, a slight push forward removes them entirely. The edges of the covers are turned down so that they fit well and allow no water to enter the engine-room. There is ample space on either side of the engine to enable one to stand beside the motor and work without being crowded.

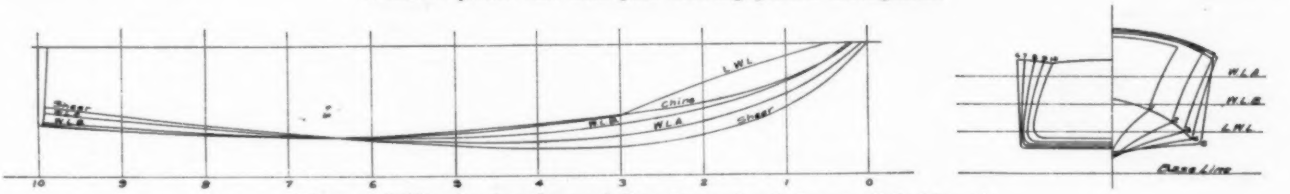
In selecting the power plant, I kept three essential things in mind; namely, it must be reliable and substantial; it must be capable of moderate speeds, and lastly, suitably adapted to the size and type of boat. For my part, I do not wish to have a racing boat, for a boat of that type is more expensive and less comfortable, although I believe the sport of motor boat racing lacks no thrills. I have chosen a four-cylinder, four-cycle, Model D Gray engine, rated at 20-24 h.p. with a speed range from 375 to 1,500 r.p.m. The engine is equipped with a Berling high-tension magneto and electric starter. An engine of this type affords easy running and with the use of a silent underwater exhaust, little noise or vibration should exist. The construction of the engine bed is, of course, of the utmost importance. Oak cross timbers, 1½ inches thick, should be fitted to the bottom and sides of the boat. About six should be used and the screws of the planking fastened directly into them. The fore and aft timbers are 2-inch by 4-inch oak, notched to fit the cross timbers and are securely bolted. This construction makes the engine foundation a part of the hull, reducing vibration to a minimum.

I believe a large drip pan installed under the engine will prove a great convenience from the standpoint of cleanliness and furthermore it will catch that nut you surely will drop and lose somewhere under the engine bed. Immediately aft of the reverse gear the 1⅛-inch bronze shafting is fitted with a Francke flexible coupling. This feature, combined with the self-aligning strut is a slight expense but a highly desirable arrangement for it prevents hot bearings and leaky stuffing boxes. The engine together with the shafting may run perfectly before launching, but all boats are slightly distorted when placed in the water. This fact usually requires realigning of the engine, but with such an arrangement as I have selected there is no danger of any binding of the shafting.

For the propeller wheel, I have chosen a three-bladed Hyde turbine type, 18 inches in



Outboard profile and deck plan showing general arrangement



Lines of Goblin showing the good flare forward and the rounded chine aft

TABLE OF OFFSETS
For 20'×5' Runabout "Goblin"
Dimensions In Feet, Inches, Eights To Outside Of Planking

	Stations	0	1	2	3	4	5	6	7	8	9	Stern
Heights Above Base	Sheer	3.2.1	3.0.6	2.10.7	2.10.5	2.10.0	2.9.4	2.9.2	2.9.0	2.8.6	2.8.4	2.8.3
	Chine	1.9.5	1.6.4	1.3.0	1.0.0	0.9.6	0.8.4	0.7.5				
	Keel		0.6.4	0.4.7	0.5.0	0.5.5	0.6.4	0.7.3	0.8.2	0.9.0	0.9.6	0.10.4
Half Breadths	Sheer		1.6.5	2.2.5	2.6.0	2.6.2	2.6.1	2.3.4	2.1.3	1.10.7	1.8.2	1.5.5
	W.L.A		1.2.5	1.10.4	2.2.5	2.2.7	2.4.3	2.3.3	2.1.6	1.11.7	1.9.5	1.7.4
	W.L.B		0.11.4	1.7.1	1.11.4	2.2.0	2.3.1	2.3.0	2.2.3	2.1.5	1.11.6	1.10.0
	L.W.L		0.3.7	0.11.5	1.5.0	1.11.7	2.1.7	2.2.7	2.2.5	2.2.0	2.0.6	1.10.4
	Chine		0.10.4	1.5.2	1.8.7	1.11.2	2.1.3	2.2.6				

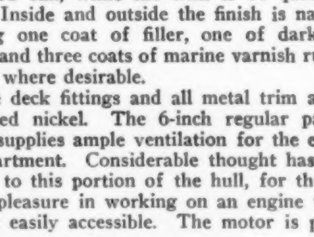
My Ideal Runabout

Goblin, the fifth of the series, is a most complete little 20-footer, a craft that any man should be proud to call his own. This little runabout is intended for use on inland waters and its proportions are such as to make it dry and safe even in rough weather.

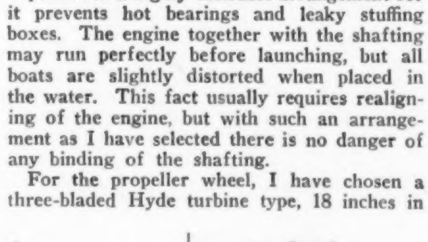
With a 20-24 h. p. motor this little craft should show a good turn of speed and afford as much amusement and real pleasure as the larger runabouts with their high-powered motors, and at the same time be an economical boat to operate.

The arrangement has been worked out along the lines that are practically standard practice in the larger craft, particular attention being given to having the power plant accessible—something that is often overlooked in a small boat. The hatches are of ample size to allow working about the motor in comfort, and a small door in the bulkhead allows making minor adjustments when under way without opening the main hatches.

All controls and instruments are mounted on the bulkhead or steering wheel column in accordance with the latest automobile practice. In fact, with the windshield and one-man top, the cockpit bears a remarkable resemblance to a touring car, but is much more roomy and comfortable.



Detail of stem construction



Detail of transom and rudder

diameter and 28 inches pitch. I believe this propeller to be best suited to the hull and engine. The outboard rudder is more convenient to get at and eliminates a stuffing box. Care should be taken to avoid short turns in the cable to the tiller arm as this not only binds the steering wheel but soon wears out the cable. I expect the boat to be capable of about 25 miles an hour which is comfortably fast.

The small door in the engine compartment bulkhead allows one to make adjustments when it would be inconvenient to open the deck covers. Every effort has been made to arrange the control to agree with that of a motor car in an attempt to avoid any possible confusion to one operating both.

The operator and one passenger are seated directly behind the engine compartment bulkhead. There is a small space between the seats. Across the stern there is a comfortable seat. The seats are upholstered in Spanish leather and are no less comfortable than those of an automobile. Besides these built-in seats there is ample room in the cockpit for two folding chairs which gives the boat a seating capacity for six persons. Every inch of available space has been utilized. Under the stern seat there is a large locker for storing of anchor, rope, and side curtains. The seat and back are easily removed. Under the single seats there is room for storage batteries, tools and fire extinquishers, beside an extra gallon of gasoline and some oil. The latter precautions will be appreciated.

The galvanized iron gasoline tank, fitted with slush plates, is installed forward and is 12 x 36 inches, having a capacity of twenty gallons. The keel is notched to receive the 2 x 3-inch white oak Sampson.

The windshield may be dropped forward. The folding auto top offers protection from rain and sun. All-wood bows with brass fittings are used in its construction. The port and starboard lights are placed in the dashboard directly below the windshield. In addition a spotlight would be very handy.

Some difficulty may be experienced in securing an all-brass windshield frame, but it will be well worth the trouble. The steel frames as used on automobiles are all right on land, but when used on a boat they rust to such an extent that it is almost impossible to move them.

The total weight of the boat should not exceed 1,500 pounds, and as for cost I would estimate that at from $1,200 to $1,300 depending upon the market and locality. An effort has been made to make the boat complete, substantial, enjoyable, and yet within the means of the average boatman. These are the things I have kept in mind and inasmuch as these ideas have been carried out, I believe I have described the runabout which to me is ideal. I find that I enjoy planning and talking about it and happily look forward to the time of its realization.

When the Bow Is Stove In

The Work That is Necessary to Patch Up a Hole in the Boat's Topsides or Replace a Broken Plank or Two

IN motor boating, as in all other sports, there are bound to be accidents; some caused by carelessness and others unavoidable. The hole stove in the bow of this boat is typical of what may be expected when a craft runs wild through a fleet. In this case a converted sailboat with long, overhanging bow ran through a fleet at anchor, and although there were two men aboard, each thought the other was at the wheel until they rammed the cruiser.

The work involved in making such a repair is not as difficult as it may seem, but requires patience and some careful fitting of the new planks. The first step is to locate the position of the frames near the hole. This can generally be done by looking for the fastenings.

After the location of the frames has been marked on the hull the next question is how much of the planking should be cut away. In making such a repair the butt-splices should be staggered at least one frame, so holes are bored where the planking is to be cut and the cut made with a compass saw. The ends are then smoothed up with a chisel so as to make a tight joint with the new pieces.

When it is possible to get at the damaged part from the inside the best results are obtained by cutting the planking halfway between the frames and putting an oak butt-block behind the splice. The block should extend the full distance between the frames and the end of each plank be securely fastened to it with screws.

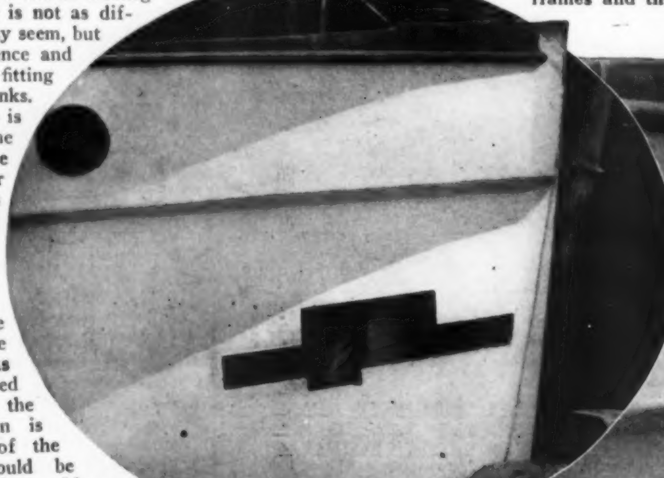
In a case like this where the damaged part cannot be reached from the inside, the planking is sawed alongside the frame and then cut back to the center of the frame with a hammer and chisel.

Very often, as was the case here, the impact is sufficient to crack or break the frames. The ends of the planking can then be cut along the side of the frame instead of the center. If the side of the boat is nearly flat, the new pieces to reinforce the broken frames can be cut from a straight piece of oak; but should the side of the boat be curved, the reinforcing pieces should be sawn or bent to the proper curve.

If the nail holes are bored in the new pieces, it will greatly facilitate matters when nailing them in place, which is sometimes easier said than done. When a number of frames are broken, especially at the turn of the bilge, the side of the hull will often bulge out considerably, making it necessary to hold it back in place with braces until the new pieces to reinforce the frames are secured in place.

After the saw cuts have been made, the old planking can be freed from the fastenings by splitting it with a chisel. Either the heads or the clinches of the old nails should be cut off so that they can be pulled through the frames without danger of splitting them.

The planking from which the pieces to patch the hull are cut should be as thick, or better yet, a little thicker than the hull planking. Each piece should be cut to a neat fit at the ends and at the sides.



Planking cut away and trimmed up smooth ready for the new pieces to reinforce the frames and the fitting of the new planks

Cutting out the damaged planking after the frames have been located. The cuts are made with a compass saw, started in a small hole bored for the purpose

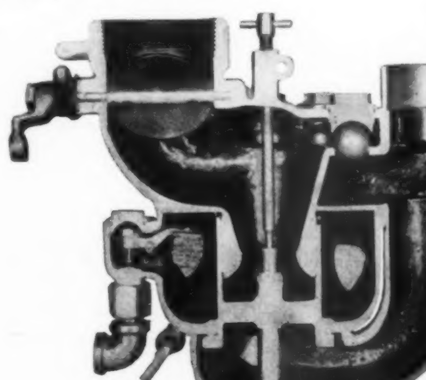
Carbureters for Marine Motors

The Adjustment of the Carbureter Not Only Affects the Running of the Motor and the Quantity of Gasoline Used, but Also the Amount of Carbon Deposited in the Cylinder

WHEN a marine motor is not running just right and there are no visible mechanical defects, it is the carbureter that gets the blame nine times out of ten, whether justly or not. This is not to be wondered at as the workings of a carbureter are not directly visible and the adjustments must be made by watching the effect on the motor. For this reason its operation as well as the adjustments seem more or less of a mystery to some boat owners.

In adjusting a carbureter there are really no difficulties to be encountered that the motor boatman cannot easily master. To be successful it must be done with clutch in and the boat in motion except when there is an idling device. In that case the main adjustments must be made in the usual way and the idling device adjusted with the clutch out.

Reduced to the simplest terms, a carbureter is a device that will meter out the gasoline in proportion to the amount of air drawn in by the motor on the suction stroke of each cylinder. This is accomplished in practically all carbureters by holding the level of the gasoline in a nozzle, located in the air passage, at a predetermined point, and as the air passes the nozzle it draws a fixed proportion of gasoline with it in the form of a fine spray. The tips of the nozzles in the various carbureters are shaped to discharge the gasoline in as fine a spray as possible.



Section through a Kingston carbureter showing the contraction of the air passage, or venturi tube, at the nozzle and the balls that form the auxiliary air valves. In carbureters of this type the amount of air admitted is controlled by the lift of the ball valves

A few carbureters used on marine motors have a plain or compound nozzle, but the great majority are built with a nozzle and a needle valve seating in the throat of the nozzle. The needle valve not only controls the flow of gasoline but acts in an entirely different rôle when the motor is not running. With the level of the gasoline below the top of the nozzle starting the motor would be rather difficult; and there is where the needle helps. The small space between the needle and the seat is kept filled with gasoline by capillary attraction so that there is always some of the liquid near the air passage ready to be picked up by the first draft of air through the carbureter.

For the slower speed motors a carbureter in which the needle valve setting remains unchanged whether running at full speed or throttled down will give the required flexibility and at the same time operate economically. With high-speed motors the best results both as to flexibility of operation and economy are generally obtained with a carbureter in which the needle valve is opened as the motor is speeded up.

In some carbureters of this type the needle is connected to and operates simultaneously with the throttle and in others it is operated by the auxiliary air valve. In either variety the result is the same. As the motor is speeded up and the velocity of the air through the carbureter is increased, the needle valve is opened allowing the gasoline to flow more freely and mix with the air in the same proportion as at lower speeds.

Nearly all carbureters are designed with a constant air passage and an auxiliary air intake controlled by an automatic spring loaded valve or a weighted valve. The purpose of this valve is to create a slightly greater vacuum at the nozzle when the motor is running slowly by drawing all the air in through the constant air passage, which causes the gasoline to flow with increased velocity through the needle valve.

A carbureter in general use on medium- and high-speed motors. As the throttle is opened the curved track under the dials opens the needle valve. The lift is controlled by the screws at the center of the dials

As the motor is speeded up the velocity of the air through the carbureter is increased and when the volume required cannot pass through the constant air passage without creating too much "back pressure" (vacuum) the auxiliary air valve opens automatically and allows some of the air to enter the cylinder without passing the nozzle.

In nearly all carbureters the air passage is contracted as it approaches the nozzle, with the smallest area just ahead of the tip of the nozzle, and beyond which point it widens out to the full area. The increased velocity of the air through the smallest part of the passage—or venturi tube—creates a slight vacuum where the tube increases in size, and produces the same result on the flow of gasoline when the motor is speeded up as the closed auxiliary valve does when the motor is running slowly.

In the Schebler and similar carbureters the action of the auxiliary air valve is controlled by a spring with adjustable tension, while in the Kingston and other carbureters using a weighted valve, the amount of air admitted is controlled by lift or the distance the balls or valves are permitted to raise above their seats. The lift of these valves is generally fixed by the carbureter manufacturer for the particular motor it is to be used for, and cannot be easily changed without getting new parts from the factory.

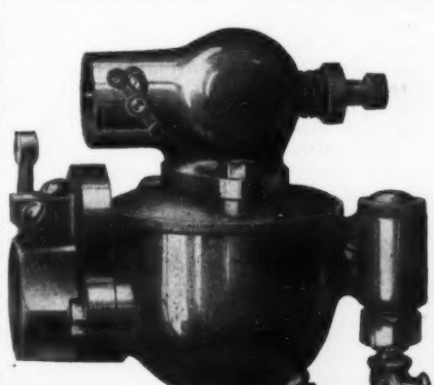
With carbureters of the so-called nozzle or compound nozzle type the amount of gasoline drawn in with each charge is controlled by the velocity of the air past the nozzle. This is done by using a choke or venturi tube of comparatively small area, thus causing a much greater difference in the velocity of the air with each change in engine speed. This change of velocity of the air through the venturi tube causes a corresponding change in the vacuum pressure that in turn causes more or less gasoline to flow from the nozzle.

These carbureters as a rule have no needle valve, or if there is one it is located between the float chamber and the nozzle. The adjustment is generally made by using a choke that is adapted to the characteristics of the particular motor that the carbureter is to be used on.

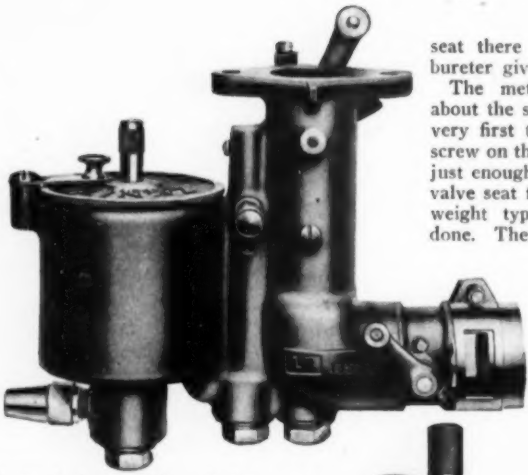
Needless to say, these carbureters are successful only on high-speed motors, and in the marine field are used with success only on motors having nearly the same characteristics as automobile engines. About the only strong argument in their favor is that once the right choke is put in the air passage there are no adjustments to be made or moving parts to get out of order.

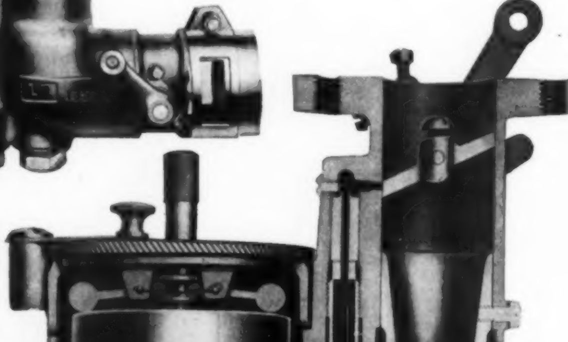
To give some idea of just how much gasoline and air pass through a carbureter, take for example an average marine motor of the four-cycle type with a 5-inch bore and a 6-inch stroke operating at 600 r.p.m. Every suction stroke will draw in about 117.8 cubic inches of air and about .008 cubic inches of gasoline from the carbureter. The two volumes have a ratio of 1 to 14,700 which probably more nearly indicate the great difference in volume of the two ingredients of the mixture.

Now, .001 cubic inch is a pretty small quantity but should the carbureter vary the amount of gasoline by that amount, it would mean, should the motor be a four-cylinder machine,



The Schebler model D, a carbureter motor boatmen have been familiar with for years. This carbureter gives good service on two-cycle and slow-speed four-cycle motors. When once set it is not necessary to adjust the needle valve for various engine speeds



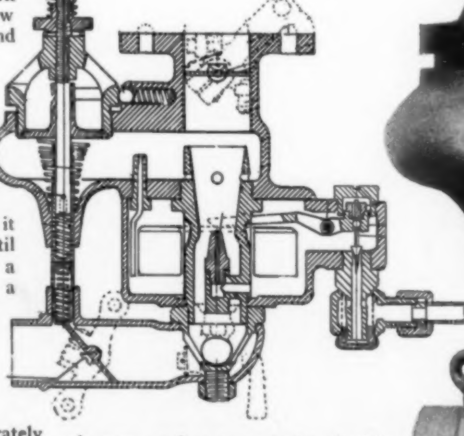


A typical example of the compound nozzle carbureter. Adjustment is made by changing the choke or venturi tube in the air passage. When the motor is running idle the gasoline and air are drawn through the orifice under the edge of the throttle valve

a difference of about 2½ pints of gasoline per hour. In one hour steady running the motor we have been considering would draw through the carbureter about 2½ gallons of gasoline and very nearly 4,850 cubic feet of air.

In order to maintain the close regulation of the mixture necessary for economical operation and perfect combustion, the gasoline in the carbureter must be kept at a constant level by the float valve. If either the float or valve do not work smoothly and easily the level of the gasoline in the bowl will not be constant, and every variation in level will vary the amount of gasoline discharged through the nozzle.

The majority of carbureters used on marine motors have cork floats, and as cork is porous, its buoyancy depends upon the amount of liquid it will absorb. In order to keep the buoyancy as nearly constant as possible, the floats are given a good coating of shellac, in fact, the outer surface of the cork is impregnated with it. Shellac is not soluable in gasoline but just the same each season's use will show its effect on the float, and if there has been much water in the carbureter, so much the worse for it. The cause of carbureters flooding and overflowing when the float valve is apparently all right, and the difficulty found in adjusting the needle valve to just the right point where it will not starve the engine or supply too much gasoline can generally be traced to a cork float that has become saturated or in a few cases the lever connecting the float and valve has been bent.



When carbureters leave the manufacturer they are adjusted in such a way that the float will keep the gasoline at a certain level below the nozzle tip and to maintain this level year after year the float must receive a little attention.

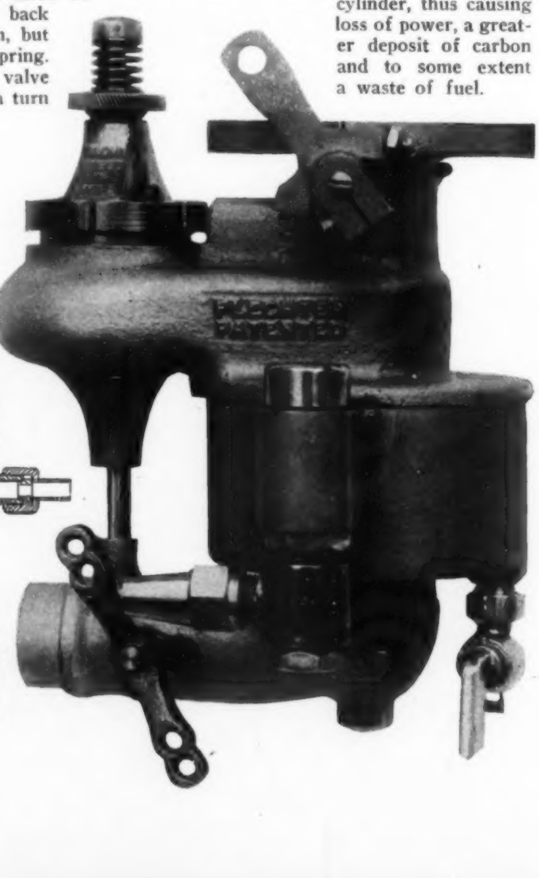
To put a cork float in good condition it is necessary only to soak it in alcohol until all the old shellac can be wiped off with a cloth. It should then be put away in a warm, dry place for several days, after that about three thin coats of good shellac will finish the job. In taking the float out of the carbureter care must be taken not to bend the lever to which it is attached.

To control the flow of gasoline accurately and produce the proper capillary effect it is necessary that the needle be straight and concentric with the seat, and the tapered point true and smooth. If it has been turned down too hard against the seat and bent or become grooved from contact with the edge of the seat there is very little chance of the carbureter giving good service.

The method of adjusting carbureters is about the same for all makes and types. The very first thing to do is to set the adjusting screw on the auxiliary air valve so that there is just enough tension on the spring to make the valve seat firmly. Of course, with the ball or weight type auxiliary valve this cannot be done. Then with the clutch in and the spark retarded, throttle the motor down to the slowest speed you expect to run it at. The needle valve should then be closed, very slowly, until the motor slows down or back fires. After you have run it this way for a few minutes open the needle valve just enough to have the motor operate smoothly.

After the slow speed adjustment has been made, advance the spark and open the throttle wide. If the motor back fires or does not run at full speed it indicates that the tension on the air valve spring is too weak. If the difficulty is not corrected by a few turns of the air valve adjusting screw go back to the slow speed adjustment again, but with less tension on the air valve spring. This will require that the needle valve be opened just a small fraction of a turn more than at the first trial at reduced speed.

A new carbureter of the double nozzle type. The gasoline orifice remains unchanged, the proper proportion of gasoline and air for varying engine speeds being controlled by the auxiliary air valve



If by any chance the air valve spring tension should be too tight when the slow speed adjustment is made, the amount of gasoline used at full speed will be far in excess of what is needed, or desirable. Whether or not this condition exists can be easily determined by closing the needle valve a little when running at full speed.

If the running of the motor is affected almost immediately it indicates that everything is all right, but if no change is noticed the air valve spring should receive immediate attention.

With the ball or weighted valve carbureters the needle valve should be adjusted for slow speed in the same manner, and if the height of the lift is correct no change should be necessary for high speed.

If the lift is too great the motor will not get enough gasoline at high speed and will act accordingly, but should the lift not be enough the motor will use far too much gasoline at high speed. Whether or not this condition exists can be easily determined by closing the needle valve a little.

By far, the greater number of carbureter troubles—and very often carbon troubles—are caused by supplying too much gasoline to the motor. This is not only an unjustified waste of gasoline, now that the Government needs it in large quantities, but is also an extra expense that most motor boatmen wish to reduce, especially with the present price of fuel.

Troubles caused by carbon in the cylinders and on the spark plugs is caused about as often by too much gasoline as from excess lubricating oil, or the wrong grade of oil. When using the proper amount of gasoline, the correct grade of oil and well-fitted piston rings, spark plugs should not need cleaning more than once or twice a season, and the carbon deposited in the cylinder should be soft and require removing only once a year.

When fitting a carbureter to a motor there is often a tendency to use a larger one than necessary. This makes starting more difficult and very often will result in using more gasoline than necessary, owing to the low velocity of the air through the venturi tube and the correspondingly greater opening of the needle valve.

With the present low grade of fuel now available it is hard to prevent the gasoline from condensing more or less in the manifold, unless the air is heated. This partly condensed vapor requires a longer time to burn in the cylinder, thus causing loss of power, a greater deposit of carbon and to some extent a waste of fuel.

THE PRIZE CONTEST

Rules for the Contest

ANSWERS to the questions addressed to the Editor of Motor Boating, 119 West 40th St., New York, must be (a) in our hands on or before **June 20,** (b) about 500 words long, (c) written on one side of the paper only, (d) accompanied by the senders' names and addresses.

The name will be withheld and initials used.

QUESTIONS for the next contest must reach us on or before the **20th of June.** The Editor reserves the right to make such changes and corrections in the accepted answers as he may deem necessary.

The prizes are: For each of the best answers to the questions below, any article or articles sold by an advertiser advertising in the current issue of Motor Boating of which the advertised price does not exceed $25, or a credit of $25 on any article which sells for more than that amount. There are three prizes—one for each question—and a contestant need send in an answer to but one if he does not care to answer all three.

For answers which we print that do not win a prize we pay space rates.

For each of the questions selected for use in the next contest, any article or articles sold by an advertiser advertising in this issue of Motor Boating, of which the advertised price does not exceed $5, or a credit of $5 on an article which sells for more than that amount.

All details connected with the ordering of the prizes selected by the winners must be handled by us.

Questions for the August Issue

1. Describe a practical method of dropping a second anchor if the first drags in a gale, so that the two will not foul.

Suggested by J. W. K., Jersey City, N. J.

2. Explain the action of a boat's propeller and rudder when backing and give instructions for maneuvering both with motor going ahead and reversed.

Suggested by A. O. G., Portland, Me.

If the Boat Must Be Kept on Shore All Summer

Answers to the First Question in the April Issue:

"Explain the best method of caring for a boat which is to be on shore all summer."

A Coat of Paint, Varnish, and a Canvas Cover a Good Spring Investment

(The Prize-Winning Answer)

A SUMMER spent upon the bank is likely to prove a greater hardship to the boat than an active season afloat. Not only are the sagging and distorting strains incident to necessarily imperfect hull support continued for many additional months but the unending process of opening up which goes on day and night while the craft is out of the water has a much longer time to progress and that under more trying weather conditions. The natural result is that the seams gape wider and ever wider until the somewhat exaggerated saying "you could throw a cat through her anywhere" begins to have at least a suggestion of fact to excuse it.

The paint and varnish suffer as a matter of course. Just how much is largely dependent upon the amount of protection provided and the condition of the finish when hauling out in the fall.

The bright metal parts of the machinery are not likely to deteriorate much during these extra months of inactivity although if rust has secured a hold it naturally keeps on spreading and intrenching itself more and more securely.

The remedy for most of the evils enumerated above should take the form of prevention to as great an extent as possible. The boat should rest in a cradle which fits the hull and should be supported equally at several points under the keel and be properly shored up beneath the turn of the bilges. We must remember that the cradle offers at best a poor substitute for the accustomed water cushion which buoys up the hull at every point and supports it without possibility of unequal strain or pressure.

To minimize the opening of the seams the boat's hull should be kept well painted. Then the craft should be thoroughly protected from the drying effects of the warm winds and bright sunshine of summer, if she cannot be well shielded by canvas coverings. This protection is even more necessary in summer than in winter, although that fact is not always recognized.

It will even repay the owner who intends leaving his craft on shore this summer to refinish the boat in the spring as usual, replacing the old paint and varnish remaining from the past season with new coatings. If the bright joiner work has blackened where the weather has been at work on bare spots it will pay him to busy himself with varnish remover and scraper and after the surface has been made clean it should be thoroughly protected by good spar varnish.

He should also see to it that the polished parts of his motor are free from rust and wherever needful should replace the protective coating of grease.

This care will amply justify itself whenever it is desired to launch the boat or in case the owner desires to sell before launching, his chances of favorably impressing the intending purchaser will be much better.

In the case of lightly-built craft exceptional care should be exercised in supporting the hull properly and protecting it from sun and wind. A lightly constructed boat may easily be ruined by long exposure and inadequate hull support.

In any case be sure to look the boat over carefully in the spring and satisfy yourself that she will go through the summer without harm. Do not do the easiest thing—just leave her as she is—because in some cases that will prove to be a very costly experiment.

A. O. G., Portland, Me.

* * *

Support, Care of the Motor, and Ventilation the Most Important Points

WHEN it is necessary to keep a boat hauled out all summer there are a number of important matters which must be attended to, to be certain that no harm will come to the boat. These fall naturally under three heads: First, the support of the hull; second, care of engine and equipment; third, ventilation and protection.

Taking them up in order: First, blocking should be carefully arranged under the keel every 4 to 6 feet so that it will be evenly supported throughout its length. It is essential that that part of the blocking resting on the ground in each pile should be large enough to have no tendency to settle under the weight of the boat. Even more important is the support under the bilges. This should be arrived at by securely shoring up under the bilge at three or four points on each side, in the way of a frame if possible, with broad, stout boards extending out from the keel under the bilge, placed at such an angle as to get as broad a bearing as possible on the boat. These boards are themselves help up against the boat by shores reaching up from the ground and securely nailed so as to avoid any possibility of slipping, and must be very securely fastened and braced. By all means avoid the miserable, though common, practice of holding up the boat by shores from the ground to the shear molding. This is certain to spoil the fair sweep of the molding and fails entirely to give support where it is needed.

The second point, care of engine and equipment, is another very important part of the work. If clearing off the hull was neglected when the boat was hauled out, it should be done now and the bilge well cleared out. The storage battery, cushions, curtains, bedding, compass, and tools, if they are in the boat, should be removed to the house and carefully put away, and if the boat has just been hauled out, or if not previously done, the engine reverse gear and all iron work should be liberally daubed with heavy grease to keep off rust, and in some communities it is unfortunately quite necessary to remove the propeller to continue to be its owner.

Third, with the exception of supporting the hull, no part of the boat's care is more important than to put on a canvas cover securely fastened and supported by a ridge pole, and above all things long enough so that the ends may be left open for ventilation. This canvas, in addition to keeping off the rain, reflects the sun and protects the boat from the direct rays of the sun, which, during the summer, would seriously dry out and heat the boat. It is absolutely essential that the ports, skylight and hatches be left partly open, so that though the rain is kept out by the canvas cover, there is a chance for a free passage of air to every part of the hull. This will effectively prevent the dreaded dry rot and keep the hull in good condition.

These, briefly, are the essential things to do if a boat is to be kept out, and if attended to carefully a boat should suffer no ill effects after a summer ashore.

H. B. S., New London, Conn.

Use a Light-Colored Cover and Provide for Ventilation

WHETHER in the open or in a boathouse, the proper blocking up of a boat is an essential matter, especially for the boat that is to be out of the water during the summer months.

As soon as the frost leaves the ground it is well to look to all shoring and wedges for possible change of position and strain. Hogging and broken ribs at the bilges can almost always be traced to this matter being overlooked. The stiffest hull is a pliable thing and incorrect blocking up during a summer layup is more disastrous than during the winter, for summer heat will thoroughly dry and fix the timbers in their warped condition.

Have the principal supports at the bow and the stern, a fair pressure at the bilge, other points being supplementary and designed to support the hull in a manner similar to when it is afloat.

Thoroughly dried planking is apt to warp and spit out the caulking. The warping is caused by unequal drying, there being, as a rule, more paint on the outside than on the inside of the planking. Hence, two coats of paint applied inside and out during April or early May (not in the fall—the extreme cold will take the life out of the paint) together with protection from the rays of the sun will do much to keep a boat in proper shape during a layup. Better still, take off all the outside paint and apply a coat of slow drying paint followed by a coat of regular paint. The slow drying paint is nothing more than oil with a little lead and drier added.

In the light of a winter layup this latter procedure may seem unnecessary, but a boat is at stake that costs more than what this effort will cost in time and labor.

The selection of a proper cover is important. Its color must be light—all over colors attract and hold the rays of the sun. The cover itself, whether it is a boat-house roof or a leanto, must be several feet above the boat so that the strata of heated air that collects immediately under such a cover will not be close enough to the boat to exert its maximum drying properties.

Regardless of the nature of the cover, there is no better place for a summer layup than a shaded ravine with a brook nearby. The evening dampness added to other precautions means more security.

Another desirable location would be the north side of a large building. When neither of these conditions can be met, a roof several feet longer than the overall length of the boat, running east and west, supported by 2 x 4's, one side boarded (the south), with no covering lying directly on the hull will afford sufficient protection for all ordinary weather.

If at stated and regular intervals a quantity of water can be put into a hull, the question of proper care during a summer layup is answered, but infrequent and irregular flooding or slushing down will do more harm than good.

J. E. M., New London, Conn.

* * *

Excessive Dryness Overcome by Salt Water in the Bilge

MEN high in Government affairs have advocated motor boating, yachting, etc., during the war period as a necessary and beneficial recreation for those who must stay at home to carry on the vast amount of work here as well as for the physical well being of those who may be "Over There" when the autumn comes. It is, nevertheless, a fact that a great many owners of pleasure craft of all types are now in the service of their country or have taken up duties which will make it impossible for them to put their boats into commission this year. For them it is necessary to properly provide for the welfare of their boats during the hot weather or have someone attend to it for them.

First of all, the plugs or whatever was removed after the last hauling out, to drain off the bilge water in anticipation of the cold weather, should be replaced and the bilges to a fair depth should be filled with sea water. If the latter is not available some salt can be added to fresh water and will serve the same purpose, i. e., to maintain moisture in the air. The salt idea is an old one and in many vessels pure salt will be found at the beam ends, under the deck at stem and stern and in all manner of places and at all times, taking moisture from the air when it is damp and retaining it for the days that are dry, thus maintaining a proper humidity and preventing dry rot and lengthening therefore the life of the wood and consequently the life of the boat. It will be observed that the plain salt is put where water never penetrates and where the heat is greatest, under the decks.

It is not necessary, however, to use pure salt in the proper care of a yacht or motor boat; it is sufficient that the bilge be filled with salt water and the floor boards removed allowing the moist air to penetrate all parts of the boat. If the floor boards cannot be conveniently removed it is well to place a few pails or other receptacles, filled with salt water, at different interior parts of the boat.

The location of the boat also has much to do with its proper care; if not a large boat it might be shifted to the north side of some building, under a shed or tree or else should be covered, with provision for ample ventilation. If the owner possesses more than one cover the lighter colored one should be used or at least placed on top as it will reflect the sun rays and the interior of the boat will be cooler.

The engine, etc., need not be bothered with if properly cared for when the boat was hauled out, except that the exposed iron and steel parts had best be covered with a new film of heavy engine oil or grease, and it will be found beneficial and advisable to coat the hull on the outside with linseed oil. This will preserve the wood and prevent it from checking and will keep the paint flexible and probably save its removal the next time she goes over.

The bilge water, however, is the most important of all and will approximate the conditions and benefits that naturally result from actually placing the boat in condition.

B. W. K., New York, N. Y.

Designing a Transom for Your Cruiser

Answers to the Second Question in the April Issue

"Explain How to Lay Out and Show the Development of a Curved Transom (Stern) with Some Rake Aft."

An Analysis of the Problem with a Direct and Accurate Solution

(The Prize-Winning Answer)

THE development of a curved transom is an undertaking that most amateur designers avoid. Perhaps it is because of the lack of information on the subject, other than in text books on descriptive geometry and there you'll find no direct connection, and partly because they think it very much more difficult than it really is. To be sure you must use your imagination a little and contemplate each step, but that is not difficult.

For my explanation I have selected the Ideal Cruiser Jerry because her stern is of conventional shape and does not call for conflicting lines in this development. So if you will just get a copy of MOTOR BOATING for September 1917, you will find a complete set of lines of Jerry and they may help you somewhat in this matter.

Now the first step is to begin visualizing. Do not look upon the accompanying drawing as a mere bunch of lines but look upon it as three different views of the stern of a boat, or better still the stern of a model. The plan view is the way the stern would look if you looked down from a bridge as the boat passed under. The sheer plan is the way the stern looks from aside. Of course, you would not see the figure of the true projected shape, it is drawn as shown simply for convenience, for I could have drawn it elsewhere but it would have been much more difficult to follow. And the end view is the way the stern, or transom here, would look if you stood directly behind it. Here as in the line drawings of practically all boats but half the boat is shown since it would be mere duplication to draw both sides.

The heavy full lines, as you have already noted, define the contour of the stern. The only other lines necessary to begin with are the buttock lines. They are lines on the surface of the model that would be cut if you passed planes (or if you sawed the model) vertically though the boat parallel to the centerline as shown in the plan view. In the sheer plan and end view these planes cut the model as shown. A very good way to visualize the development is to consider that we have a large sheet of paper cut to the true size and shape of the transom and pasted thereon. Then to develop the transom we would merely peel off this paper coating, in other words we are going to roll the transom out flat and see what it looks like. This would be the developed or true projected shape. It should be noted that the letters on the drawings are congruous, the point M being the middle of the top edge in all three views, the point D being the outer corner in all three views, and similarly for all other letters.

Before developing the true shape it is first necessary to accurately determine the line representing the outer and bottom edge of the transom especially in the sheer plan. When the boat is being designed the designer chooses the rake, here shown by the line MN in the sheer plan, then going to the plan view he takes his compass and draws the arc MABCD which represented the curve of the top edge of the transom when looking vertically down upon it.

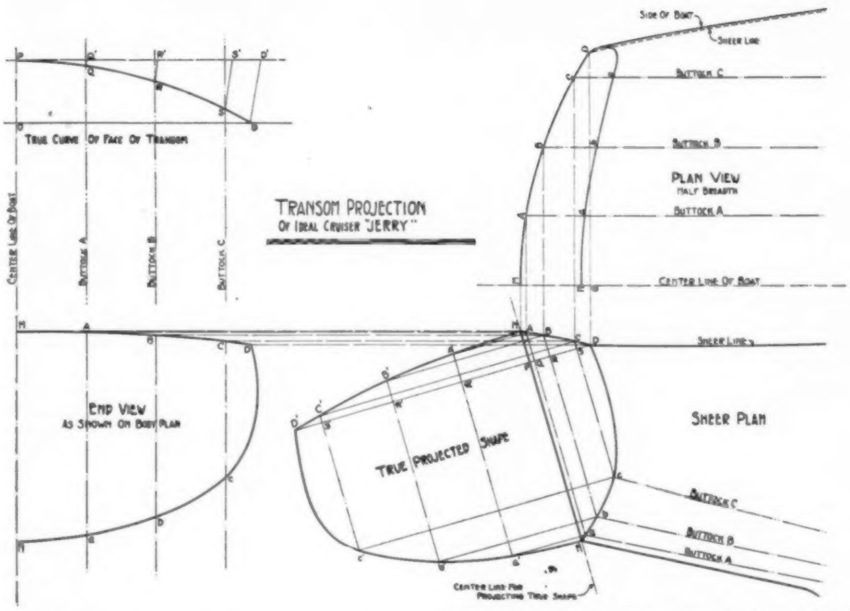
The amount of crown or camber of the after deck helps him determine the height of the point M; with this he proceeds to draw the arc MABCD in the end view. Then by projecting horizontal lines from the end view and vertical lines from the plan view we determine the edge MABCD in the sheer plan by noting where these projected lines cross, as shown in drawing. These points of intersection also indicate where the buttocks cut the top edge of the transom. So drawing buttocks through these points parallel to MN in the sheer plan we get the line DCBAN as shown. Projecting back across and up from these points we obtain the same line on the other two views. I dwelt upon the above because if that is not done correctly and accurately your final development is worthless. From now on we shall confine our attention solely to the sheer plan and the upper left hand figure.

When we roll out, i.e., develop, the transom to get the true shape we do so about the

line MN, the latter acting like a hinge, and all points on the true projected shape must be layed off from MN as a centerline. Hence a line scratched on the transom from P to D, would, if viewed along the line MN, show the true curve of the face of the transom. So in the upper left hand figure OP is layed off equal to PD in sheer plan, Q is layed off from the line OD to DR, and S from line OD equal to DS. OD equals the half breadth of the transom at the sheer as shown in plan view. The point Q is where Q would strike if the curve were rolled along the upper line, likewise R would strike at R', etc. In other words PQ = PQ', PR = PR', etc. To locate point Q' take your dividers and divide the arc PQ into about three equal parts and step off the same number along the upper line thus locating Q', likewise for R', S', and D'. These distances give the locations of the buttocks, A'a', etc., in the true projected view. Drawing these buttocks parallel to MN projecting from A, B, etc., as shown we determine points A', B', C', etc., and hence the true projected shape. This then is the templet by which you lay out the transom, but enough wood must be left around the edges to allow for beveling.

P. L. R., Cambridge, Mass.

* * *



P. L. R.—The true projected shape developed from the deck plan, sheer plan, and buttock lines

A Method for the Mold Loft

WHEN you have the lines of the transom on the floor you may proceed as follows:

Draw the base line A-B, perpendicular to the line C-D, which is the line of intersection of the centerline of the boat and the transom.

Take a batten ½ x ½ inches, hold the end on the centerline of the boat at one of the waterlines in the plan and girth the transom to the buttocks. Hold the same end of the batten at the intersection of the base line A-B and the centerline C-D, locate the buttocks on the base line at E and F. Draw the buttocks through these points parallel to the centerline C-D.

Draw a line parallel to the base line A-B through the following points: G, H, J, K, L, M, N, O, P.

Girth the line Q-R, hold the centerline at S and locate the point T.

Girth the line U-V, hold the centerline at W and locate the point X.

Girth the line Y-Z, hold the centerline at AA and locate the point BB.

Girth the line CC-DD, hold the centerline at EE and locate the point FF.

Point GG is located by the projection from the point N.

Girth the line HH-JJ, hold the centerline at KK and locate the point LL.

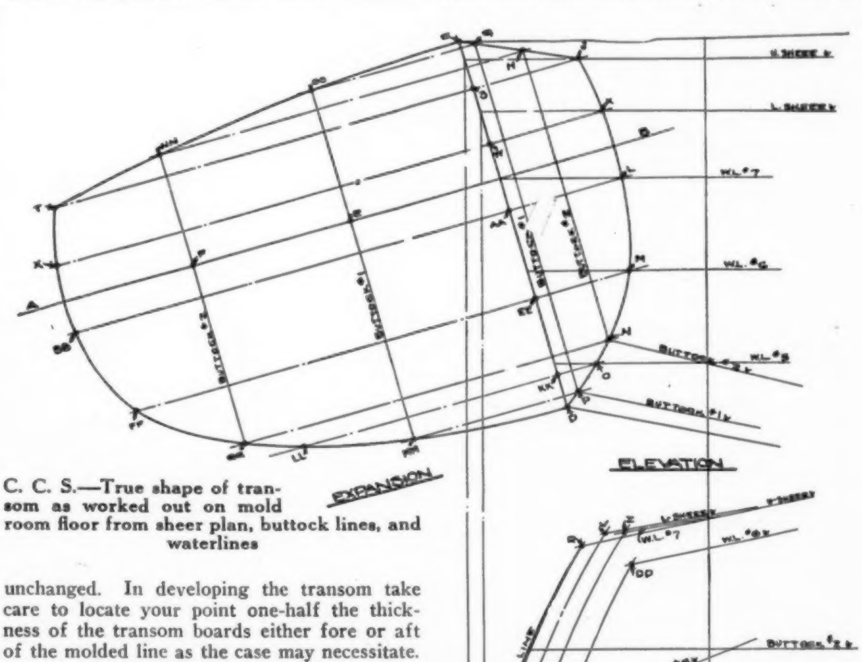
The point MM is located by projection from the point P.

The point NN is located by projection from the point H.

The point OO is located by projection from the point G.

Take a batten of suitable size draw a line through the points D, MM, LL, GG, FF, BB, X and T. This should be a fair line. Draw a line through the points C, OO, NN, and T. This should also be a fair line.

It must be remembered, when bending a board the outer and inner sides expand and contract respectively, but the center remains unchanged. In developing the transom take care to locate your point one-half the thickness of the transom boards either fore or aft of the molded line as the case may necessitate.



C. C. S.—True shape of transom as worked out on mold room floor from sheer plan, buttock lines, and waterlines

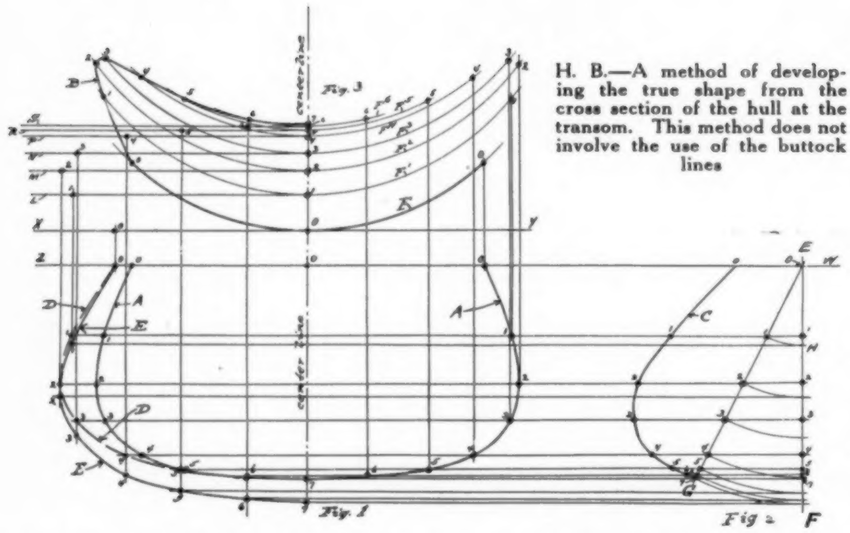
Remember the bevels also. It is better to lay the work off on the forward side of the boards, lift the bevels and add one-half to the developed line; saw out and mark back on the after side of the boards, the full bevel.

C. C. S., Newport News, Va.

* * *

An Unusual Method

THIS involves the application of the principles of descriptive geometry, but I will try to explain the procedure so that the apparent and the true shapes of any form of curved transom may be laid out, without entangling the reader too deeply in the technical details of a somewhat involved subject. The layout should preferably be made full size on a smooth flat surface. First, draw the shape of the cross-section of the hull at a point directly in front of the transom, which will be the apparent shape of the transom as viewed from directly astern. This shape must be obtained from the lines of the boat as given by the designer, and is shown in Figure 1 as the curve A. Draw the vertical centerline, and the deck line ZW, here shown without crown, for simplicity. Extend the line ZW to the right to a convenient distance for Figure 2. Draw a vertical line EF through O, Figure 2, and in the same figure draw the line EG through O at the angle of rake which the transom is to have. Except for this slanting line EG, all the straight lines in the figures of the drawing are exactly at right angles or parallel to one another; and as this relation is vital for accuracy, great care must be taken to maintain it throughout. Extend the centerline of Figure 1 upward and draw across it the curve F, Figure 3, of the shape which the after edge of the deck is to have, where it meets the transom. This may be of any curvature desired; and it is here shown of a rather sharp curvature, to make the principles involved more clear. This curve must be exactly symmetrically positioned relatively to the centerline of Figures 1 and 3. Next divide the curve A of Figure 1 into any desired number of parts, symmetrically placed on opposite sides of the middle point about as shown, and number them for identification. Draw horizontal lines through all points, extending across to Figure 2, and vertical lines through all points, extending to Figure 3. Lay off on the centerline, Figure 3, the distance O-1 equal to the distance 1-1 intercepted between lines EF and EG in Figure 2; lay off also on the centerline, Figure 3, the distance O-2 equal to the corresponding intercepted distance 2-2, Figure 2, and so on for the seven points. Through each of these point one, two, three, four, five, and six, on



H. B.—A method of developing the true shape from the cross section of the hull at the transom. This method does not involve the use of the buttock lines

the centerline, Figure 3, draws a duplicate of the deck line curve F, each such curve being symmetrically positioned relatively to the centerline, as before. Draw a vertical line from the point O at each end of the curve A, Figure I, till it crosses the curve F drawn through the centerline point O, Figure 3, and mark the points of crossing so they can be identified, as shown. Repeat this operation from every other point on the curve A to the corresponding curve F; and it is only necessary to do all this work on half of the layout, if desired. Through these newly found points may now be drawn the curve B, Figure 3, which is the apparent shape of the edge of the transom, viewed from directly above.

Now draw the horizontal line XY through the centerline point O of the curve F, Figure 3. Measure the vertical distance from the line XY to the right hand point O of the curve F, and lay it off to the left of the line EF from the point O on the line ZW, Figure 2, marking the point thus found so it can be identified. Repeat this same transfer of distances for each of the points one, two, three, four, five, and six, Figure 3, laying them off on the first, second, third, fourth, fifth, and sixth lines, respectively, from the top line of Figure 2. Through the points thus found, and also the point 7 at the bottom, draw the curve C, which is the apparent shape of the edge of the transom when viewed from directly at right angles to the boat.

Now, to obtain the true shape of the transom we must flatten it out; and also we must swing it so that it lies in a plane at right angles to the observer's line of vision; that is, in the plan of the drawing. The first of these operations is accomplished as follows:

Through the points one, two, three, four, five, and six, on the centerline of Figure 3, draw the horizontal lines L, M, N, P, R, and S. With a pair of dividers, set at about one-tenth the length of the longest curve F, start at the left end of the curve F, Figure 3, and step along the curve till the center point O is reached, or slightly passed; then from the spot thus reached, step backward the same number of steps, but along the line XY, and toward the left, instead of along the curve F. A new point O, on the left portion of the line XY, will thus be located, which is exactly as far from the centerline of this figure as is the left end O of the curve F measured along that curve. This operation must be performed by stepping off with dividers, as described, and cannot be done with compasses swung about the centerline at O as a center. Repeat this same operation for each point one, two, three, four, five, and six, along the lines L, M, N, P, R, and S, respectively. Number each of the new points for identification and through each such point draw a vertical line to Figure 1. Where the vertical line through new point O, Figure 3, crosses the horizontal line ZW, Figure 1, at the left, mark the point for identification; and do likewise for the crossing of the vertical line through the new point one, Figure 3, and the horizontal line through point one, Figure 1; and the same for points two, three, four, five, and six. This will give a series of points through which can be drawn the curve D. This curve is the apparent shape of the flattened-out transom when it slants away from the observer at the angle of slant shown by the line EG, Figure 2. Now, to get the final curve showing the true shape of the transom, proceed to Figure 2, and with a pair of compasses centered at O, where the lines EF and EG intersect, and with O-1 along line EG as radius, swing an arc so as to cut line EF at a point H. Through H draw a horizontal line across Figure 1, and where it crosses the extended vertical line through the point 1 on curve D, mark a new and final point 1 for identification. Repeat this operation for each point two, three, four, five, six, and seven of Figure 2. Some of these horizontal lines are omitted from the present drawing, to avoid confusion. Through these new points on Figure 1, draw the curve E, which is the actual and true shape of the left half of the transom. To obtain the right half is obviously simply a matter of duplication. H. B., Washington, D. C.

* * *

A Method for the Drafting Board

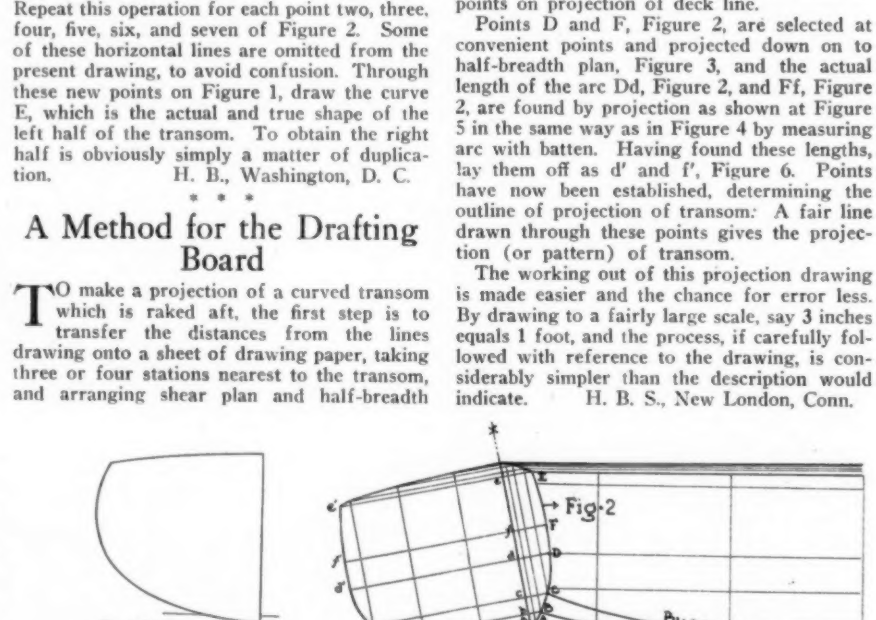
To make a projection of a curved transom which is raked aft, the first step is to transfer the distances from the lines drawing onto a sheet of drawing paper, taking three or four stations nearest to the transom, and arranging shear plan and half-breadth plan parallel and one above the other just as in the drawing which you are working from, as shown in accompanying drawing. The projection is developed using as a centerline the line XY which is the line at after edge of shear plan.

Referring first to the drawing, Figure 1 is end view of transom as it appears in body plan. Figure 2 is side view of transom as shown in shear plan. Figure 3 is bottom view of transom as shown in half-breadth plan. Figures 4 and 5 are explained later on. Figure 6 is the projection of the transom, or in other words, the transom as it would appear if laid out flat.

As shown in Figure 2, taking XY as a centerline, project buttock lines from point where they cross edge of transom at A, B, and C, parallel to XY. Also project at right angles to XY, the points A, B, C, D, and E, and points on top edge where projection of buttock lines cross deck edge. Next as shown in Figure 4 lay off SE equal to width of boat at transom found by projecting ER as in Figure 3, and erect perpendicular SV equal to Ee, Figure 2 (the amount of curvature in transom). Lay off on line SE, AB and C spaced as corresponding distances in Figure 3. Draw the arc of the circle VE. The length of the arc VE is the true width of the transom measured on the surface from centerline to deck edge E. With a batten measure carefully from V along arc to intersection of projection of A on arc, and the result will be the actual length on the transom from centerline XY to A, Figure 2. Lay this off from a to a' (Figure 2) and you have established a point on edge of transom projection. In the same way project points a' b' c' on projection of buttock plan as in Figure 6. From a' b' c' project lines up parallel to XY as in Figure 6 and where they intersect the projection of the intersection of buttock lines on deck line you will establish a series of points on projection of deck line.

Points D and F, Figure 2, are selected at convenient points and projected down on to half-breadth plan, Figure 3, and the actual length of the arc Dd, Figure 2, and Ff, Figure 2, are found by projection as shown at Figure 5 in the same way as in Figure 4 by measuring arc with batten. Having found these lengths, lay them off as d' and f', Figure 6. Points have now been established, determining the outline of projection of transom. A fair line drawn through these points gives the projection (or pattern) of transom.

The working out of this projection drawing is made easier and the chance for error less. By drawing to a fairly large scale, say 3 inches equals 1 foot, and the process, if carefully followed with reference to the drawing, is considerably simpler than the description would indicate. H. B. S., New London, Conn.



H. B. S.—Method of working out true shape from the line plans using both the buttock lines and waterlines

The Key Which Stuck

Answers to the Third Question in the April Issue

"Describe a Practical Method for Removing a Rusted or Frozen Key from Its Keyway."

If Heat and a Drift Fail, Drill it Out

(The Prize-Winning Answer)

FILE the shaft on both sides of the wheel close to the key and in the keyway, to remove all rust, bruised or rough spots. With a sharp pointed knife blade, or file tang, scrape closely about the key, bore of wheel and in the keyway, to remove the rust that the file did not reach.

Use your gasoline torch or paint burner, playing the flame on the hub of the wheel until it is very hot to touch. Remove the torch, and pour a small quantity, a few drops at a time, of kerosene oil from a squirt can, alongside of the key, at the bore of the wheel and in the keyway.

Tap the sides of the key slightly, and hub of the wheel heavier, with a hammer, while pouring on kerosene oil—continue this performance for about ten minutes. Most of the kerosene will evaporate from the heat, but a portion will penetrate and break the rust joint between the key, shaft, and hub. The hammering helps.

After three or four hours, repeat the operation of heating, oiling, and hammering. Three complete performances should be sufficient. This gives time for the kerosene oil to penetrate the joint.

When cool place a block under the flywheel to prevent springing the shaft, use a bar and medium weight hammer (about three pounds and drive the wheel toward the small end of the key. Don't hammer too hard or you may cause trouble inside the crankcase.

If the wheel is against the crankcase, or against the shoulder on the shaft do not attempt to drive it.

If the key has a head (it should have) get the blacksmith to make a flat steel key drift or wedge about 10 inches long with square corners (or edges).

The illustration shows the condition with no projection. Block the lower end of a monkey wrench to hold it in position. Then by hammering on end of drift, the key generally comes out.

If the head breaks off, or there was no head originally, make a hacksaw cut ½ or ⅝ inches from the end, cutting down until you touch the shaft, make another cut nearer to the hub, and with a chisel and hammer, chip out the metal between. This gives a makeshift head to drive against.

Bend a chisel in such a shape that the dull cutting end touches the makeshift head, heel of bend against the hub of the wheel, outer end in such a position that it can be struck with a hammer. You can generally drive it out this way.

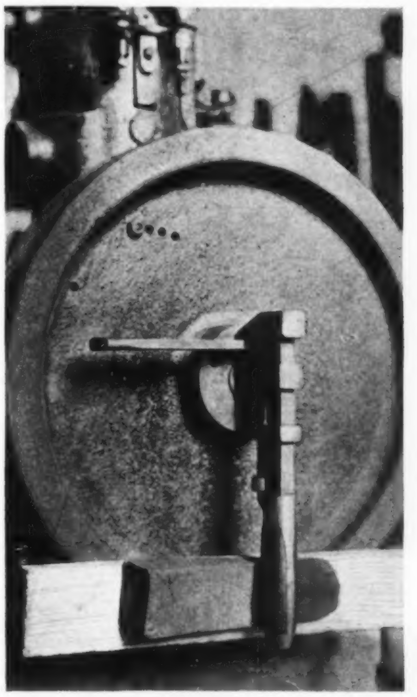
If this all fails, drill it out. Chip off the key flush with the hub, the center punch to be carefully placed in center sidewise, and nearer shaft than center up and down.

Line the ratchet carefully. Drill easily. Don't hurry the job. If it should run out, it is better to cut into the hub than spoil the shaft.

A taper key at the small end is generally two-thirds of width. Use a twist drill less than the key width, although it generally pays to drill out the full width of the key and cut a new keyway into the hub.

Now drill holes in web of the wheel, close to the hub, and on opposite sides of the shaft, then with long threaded bolts and a piece across the end of the shaft, draw the wheel off by turning up on the nuts.

This drilling must be done carefully. In any case go carefully. Do not break your drill, or you will be worse off than before.



D. A. R.—A wrench properly blocked will hold the drift in place and prevent the key from being marred

The drift method generally works successfully, if the heating, oiling, and hammering has been done thoroughly. Kerosene oil has a wonderful penetrating quality and disintegrates rust. In combination with heating and hammering it will tend to loosen the nuts, screws, and connections that would have to be scraped otherwise. The drift method is not entirely original with me, I have used it for several years.

D. A. R., Newcastle, Pa.

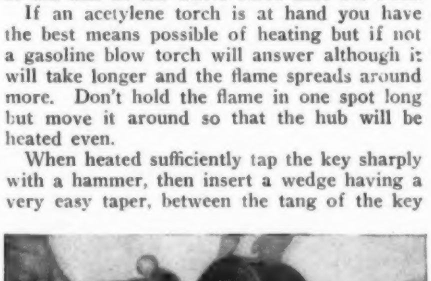
* * *

Heat and a Wedge Generally Successful

A RUSTED or frozen key can often be loosened by a smart blow from a hammer, but if this fails to start it, the heating of the hub of the wheel often does the trick.

If an acetylene torch is at hand you have the best means possible of heating but if not a gasoline blow torch will answer although it will take longer and the flame spreads around more. Don't hold the flame in one spot long but move it around so that the hub will be heated even.

When heated sufficiently tap the key sharply with a hammer, then insert a wedge having a very easy taper, between the tang of the key



D. E. W.—After heating the hub a drift driven under the head of the key will generally start it

and the hub and drive with light blows, this treatment is pretty sure to give results. But in obstinate cases the use of two wedges is better, driving one from each direction, this prevents the wedging of the key against the side of the keyway and lessens the danger of twisting the tang off.

In some cases the only way to get the key is to draw the wheel off with a wheel puller when the key will sometimes come with the wheel, or if the wheel slips off and leaves the key in position, it can be cut out with a cold chisel.

D. E. W., Ithaca, N. Y.

* * *

Use Kerosene and a Key Puller

REMOVING a rusted or frozen key from its keyway is sometimes a rather difficult proposition, but it is a condition that is quite frequently encountered on marine motors, owing to the constant presence of moisture in and around the boat. A key that has not been removed for a couple of years is very likely to have become rusted, unless it is so located that oil gets to it constantly. All sorts of means are resorted to in the effort to start the obstinate key, such as hammers, chisels, wedges, levers, heat and kerosene with more or less satisfactory results.

If a key is rusted, there is one thing that will help greatly in loosening the rust and that thing is kerosene. If the part is such that it can be entirely immersed in kerosene, it is well to let it soak for several hours or even for a couple of days, as this will greatly assist the process of removal. If, however, the part is too large or is attached to the motor, the next best thing is to wrap it with a lot of rag or cotton waste and keep this saturated with kerosene. After the kerosene has had a chance to act on the rust, mechanical means will do the rest.

The most effective weapon to use is what is known as a key puller which may be purchased at almost any large hardware store. This tool is made of steel and consists of a bar with the ends forged into hooks, one hook having an abrupt curve and the other a gradual curve. The hook with the more gradual curve is used first to start the key and the one with the abrupt curve serves to withdraw it. When the puller hook is placed between the head of the key and the hub of the flywheel, or whatever part is keyed to the shaft, a sort of cam action is obtained by which the force of the hammer blows on the opposite end of the puller is increased many times, so that the key will usually start after a few strokes. In use, the point of the hook is placed behind the head of the key and the curved portion against the edge of the part that is keyed on.

If this tool is not obtainable, it is often possible to use a short crow-bar with a curved end which acts in a way very similar to the regular key puller. Wedges of steel driven in back of the head of the key will often start it also. It may at times prove of assistance to make use of a blow torch to heat the collar or hub of the keyed on part, at the same time keeping the shaft cool by pouring water over it. This will cause the encircling part to expand, thus making a sort of temporary loose fit so that the key will start.

These are the most practical methods for removing a rusted or frozen key from its keyway, and in nine-tenths of the cases they will prove effective. However, this sort of a job requires patience and it must also be done carefully. If the key does not start at once, keep at it and, unless it is rusted absolutely solid, it will yield to one of the above methods. A little patience, care, and the proper tools will do the trick.

A. L. M., Brooklyn, N. Y.

Building a War Time Knockabout

A Seaworthy 20-Footer Which Is Easy to Build, Economical to Operate, and Will Afford Maximum Pleasure at a Minimum Expense

PART II

(Continued from the May issue)

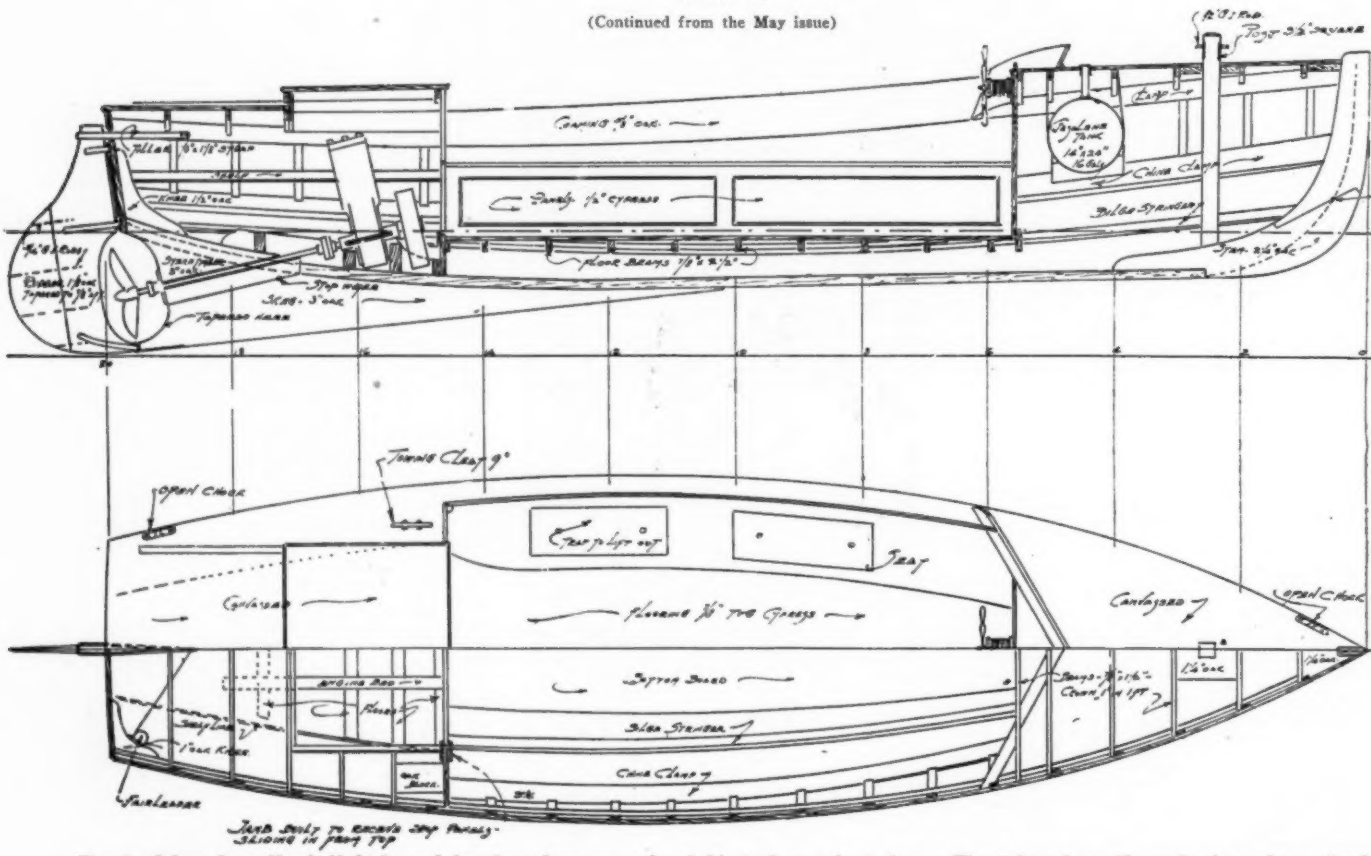


Fig. 1—Inboard profile, half deck, and framing plans, at scale of 3/8 inch equals 1 foot. The inboard profile and plans show clearly the method of construction, how the motor is installed, and the general arrangement throughout

THE DECK

When the planking is completed, knock out the braces and turn the hull right side up. Put blocking under the keel at several points and hold it steady by braces nailed to the floor. Do not remove the molds until the deck beams and engine bed are in place, and it is best to leave the stern deck till the bilge stringers are in place.

The deck beams are to be made of cypress or spruce, 7/8x1 1/2 inches and sawed to the proper crown. All the forward beams are cut to a radius of 5 feet 4 inches, and all the after beams to a radius of 8 feet 6 inches.

Notches 1-inch deep are cut into the top of the sheer clamp to receive the deck beams, while the ends of the beams are notched from the bottom to fit against the clamps. The breast hook should be a neat fit into the clamps. Oak blocks 1 3/4 inches thick should be fitted between the deck beams for the bit forward and for the cleats just aft of the engine compartment bulkhead.

When fitting the deck beams, the one at each end of the cockpit should be put in first and the rest of them fitted and leveled up by the use of a straight-edged plank. The deck beams are to be securely nailed to the sheer clamps and frames.

After the deck beams are in place and before the molds are removed the engine bed should be installed. After that continue with the deck. The deck planking should be of 5/8-inch cypress or pine boards, tongued and grooved edges, free from knots and about 3 or 4 inches wide. The cover board (plank at edge of deck) along the coaming should be sawed to the proper curve from one piece, and let it extend beyond the ends of the cockpit as far as possible. Beginning at the center of the forward deck lay one plank with its edge on the centerline of the boat, then work the planking to both sides. It will probably be necessary to cut the last plank to fit against the cover board.

After the decking is laid, set the nail heads and smooth up the entire surface to an even curve with a plane. Then plane up the edges of the deck flush with the sides and at the same angle.

The stern deck should not be laid until the hatchway has been framed and fitted. The after deck is laid and smoothed up in the same manner as the forward deck. The hatch guides should not be put on until the deck has been canvased and given a coat of paint.

Use 8-ounce canvas of a width to cover the deck in one piece. The most economical method will be to use one piece of canvas for the bow deck, another for the stern deck, a piece for the hatch, and strips cut from the edges for the deck alongside the coaming.

It requires some care to canvas a deck and have the canvas remain flat. Have the canvas dry and warm, cut roughly to fit and then give the deck a thick coat of paint. Lay the canvas over the wet paint, stretch it fore and aft and fasten with tacks. Turn the canvas over at the edge of the deck, pull it tight and fasten with galvanized tacks driven so that they will be under the sheer mold.

The canvas on the stern deck should be tacked along the edge the same as the bow deck, but along the hatch the tacks should be driven so that they will be under the hatch guide. Along the cockpit the canvas should be turned over both edges of the cover board and the tacks driven so they will be under the coaming or the sheer mold.

As soon as you have the canvas securely tacked give it a thick coat of paint to which has been added about one-half of its volume of raw linseed oil. This will soak into the canvas, make it stick to the deck, and at the same time act as a filler for the following coats.

THE ENGINE BED

After the deck beams are all in place remove station molds Nos. 12 and 16. Then take the diagram that was drawn up to find the location of the shaft hole and check it back against the hull as you built it. To do this stretch a string from the center of the outside end of the shaft hole to the mold at station No. 8, so that the string represents the centerline of the shaft. If your sketch of the engine bed is nearly correct, proceed to cut the members from 2 1/2-inch oak or yellow pine planks to approximately the dimensions indicated by your sketch. The final fitting should be done by the cut and try method in the hull itself.

The engine bed shown in Figure 1 has four cross pieces, or floors, with two bed stringers. The floors extend across the bottom from one bilge stringer to the other. (Read description of bilge stringers before putting in engine bed.) The engine bed proper is halved into the cross timbers, and fastened with 3/8-inch galvanized bolts, and each floor is bolted to the keel with a 1/2-inch galvanized bolt as shown in Figure 2, and at the same time nail the bottom planking to the floors from the outside.

Now don't forget to bore the limbers, as shown in Figure 2, before finally bolting the floors fast. It will be even a more satisfactory engine bed if the bed stringers are kept about an inch from the bottom so that any water which might collect at the sides will run to the bottom. In any case, the floors must be a neat fit to the keel plank and sides.

The top of the bed stringers should be leveled by means of the string, making the necessary allowance for the distance from the centerline of the shaft to the under side of the bed plate on the engine to be installed. (This dimension varies with every make.) Plane the tops of the beds smooth and straight and at the same angle as the centerline of the shaft. Do not be afraid to make the engine bed too long. The longer the better, spreading the floors apart as you lengthen the bed.

BILGE STRINGERS

After the engine bed has been completed the rest of the molds can be removed. It is best to nail three temporary braces across the cockpit at stations Nos. 8, 12, and 16 before removing the molds. The bilge stringers are ⅞x2½ inch oak strips long enough to reach from the stem to the transom. They are to be placed half-way between the keel plank and chine as shown in Figure 2, and are fastened to each bottom board by two galvanized nails clinched on the inside as was done with the planking between the chine and deck. The bilge clamps should be a neat fit up to the stem and against the transom. These stringers serve not only to hold the bottom planks together but also carry the weight from the floor beams.

THE COAMING AND COMPANION SLIDE

The coaming should be cut from ⅝-inch oak and counterbored for the fastenings. First cut and fit the two pieces for the forward end. As shown in Figure 1, the center of the coaming extends over part of the deck and at the sides projects over the cover board. These two pieces are tilted forward at an angle so that any water which may come back over the deck will be thrown to the side and forward instead of straight up as would be the case were the coaming vertical. Care must be used in cutting and fitting these two pieces, as any mistakes will show and, besides, the joint should be water-tight.

After the forward coaming is in place, cut the ends of the side coaming to the proper angle and bevel. The after ends should be cut square at the bulkhead. The coamings should be cut so that the finished width will be 8 inches, 4 inches of which should be above the deck. The top of the coaming should conform to the same curve as the sheer and decks. The bit, made of 3½-inch square oak, should now be put in and have the lower end securely fastened—or better, mortised—to the stem. Be sure the bit is secure, as the safety of your boat depends upon its holding.

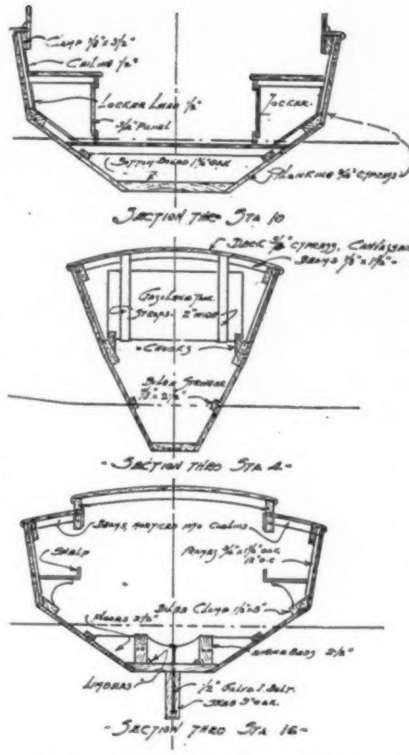


Fig. 2—Sections showing construction details. Scale ⅜ inch equals 1 foot

THE ENGINE HATCH

The first pieces to be gotten out are the two guides. These are cut from 1⅜-inch oak and should be about 4 inches high at the forward end and tapering to 2½ inches at the after end. A groove about 3/16 inches wide and ½-inch deep should be cut parallel to the top and 1½ inches from it for the brass plate on the hatch to slide in, and the top should be beveled to the crown of the deck as shown in the detail drawing in Figure 1, illustrated in the May issue. These are securely fastened to the stern deck, over the canvas, by screws, with the heads countersunk and plugged.

For the average engine, a distance of 3 feet between the guides and a hatch 2 feet and 8 inches long will provide ample space for the necessary adjustments. The size of the hatch, however, should be worked out to suit each particular motor installation, and the guides should be twice the length of the hatch plus 6 inches, and finish at the after end with a 4-inch O. G. curve.

The end beams for the hatch are 1¼ inches deep and made from ⅞-inch oak, the top being cut to a radius of 8 feet 10 inches. The hatch is made of ⅞x3½-inch tongue and grooved cypress or pine, securely nailed to the two beams. The two outside pieces should be ⅞x6-inch oak, as they have to take the wear along the guide.

The hatch is smoothed up and canvased in the same manner as the deck. The 1½-inch half-round molding on the sides covers the tacks and prevents water running ning in over the guide. After hatch and guides are completed and in place, finish off with a ½-inch oak facia board as shown in Figure 1 in the May issue. To prevent the hatch from being lifted off, make four plates of ⅛-inch brass, ¾ inches wide and 3 inches long with two holes for screws and attach them to the beams so that ends run in the grooves.

A neat and effective hasp for locking up the engine compartment is detailed. It is easily made and the drawing needs no explanation.

THE BULKHEAD AND COCKPIT

The bulkhead should be built of ⅞x2½-inch tongue and grooved V-joint cypress or oak, set upright. The removable section can best be made in two pieces with the joint half way up. They can be made either as panels or, perhaps better, of the same V-joint material as the bulkhead, using battens on the inside. Pieces about 3 inches wide should be fastened to the inside and outside of the bulkhead so as to form grooves for the removable section to slide into, as shown in Fig. 1. A piece of ⅞x3-inch board should be fastened across the bottom of the opening just inside of the removable section to prevent water from running in along the floor.

The cockpit can be fitted with seats and lockers, as shown in Figure 1, or with slatted seats made of ⅞x2-inch slats, or just left open. In any case it is a good idea to finish off the exposed parts of the sides with the same V-joint ceiling boards as were used in the bulkhead. Where lockers are built, they should be lined inside with ½-inch boards as shown in Figure 2.

The forward bulkhead should be made of the same material as the engine compartment bulkhead. Be sure to provide a large size door in this bulkhead as it will prove a most

(*Continued on page 84*)

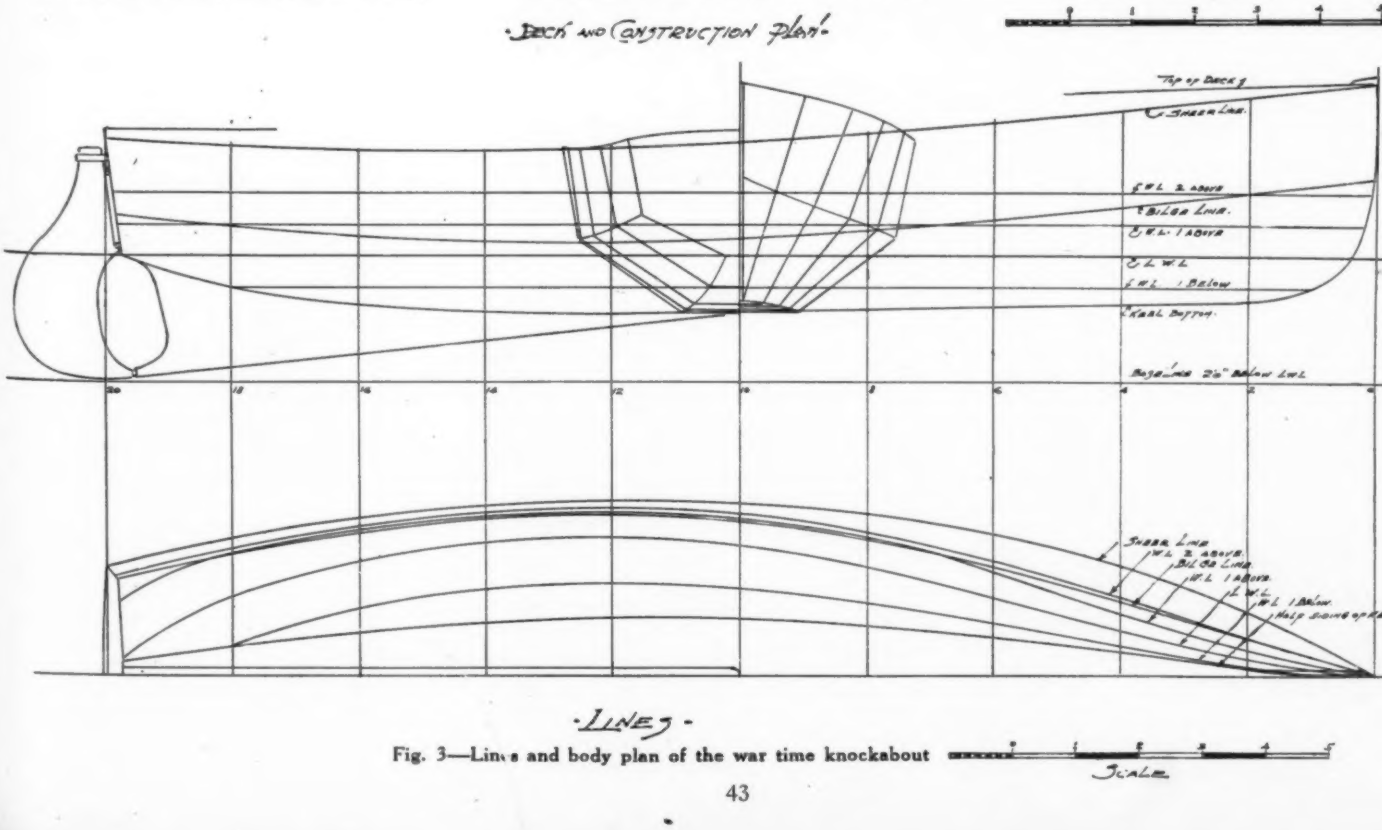


Fig. 3—Lines and body plan of the war time knockabout

What Constitutes a Comfortable Cruiser?

By F. T. Lander

As will be remembered, Mr. Lander designed the 36-foot Sunray, the winner of Motor Boating's Ideal Cruiser competition held recently. In many respects Sunray was novel and showed the possibilities in the design of a cruiser as small as 36 feet in length. The same amateur designer has just produced something which is even ahead of his last effort—a 42-footer, so arranged and planned that ten or eleven persons can live comfortably aboard. Study the design carefully, particularly the manner in which Mr. Lander has provided sleeping accommodations. See if you can suggest any improvement in a boat of about this size. We will be pleased to receive any criticisms or discussions which any of our readers may care to offer.—Editor.

If we all thought alike about boats there naturally would be but one, and only one, type in existence. Each boat would be identical with the next in every respect. Luckily, however, this condition does not prevail, for if it did the sport would soon dwindle to little or nothing.

It can be said, then, that the popularity of the sport is largely due to the fact that there are practically no limits as to kinds and classes of boats from which to choose. Take cruisers for instance: One may have a snug little 18- or 20-footer, or he may go to the other extreme by ordering a certain type of battleship. In between these limits there are dozens of other types; for the word cruiser seems unusually elastic.

While a cruiser is supposed to be a craft in which one cruises, there is a large percentage that are never used as such, but mainly for ferry service or afternoon sailing. The express cruiser is an example. Here is a type which possesses cooking and sleeping facilities of a certain kind, yet one rarely used for cruising; for speed and not comfort is the predominating feature.

But what does comfort afloat really mean? This is a matter that has never been clearly defined. What one may consider a comfortable cruiser another will pronounce quite the contrary. Considering the cruiser in its true sense: that is, a boat which is propelled by some motive power and in which folks may live for periods of say two weeks or more, it would seem that the first requisite toward real comfort is to have things compare as closely as possible to those at home. Now this is so obvious that it hardly seems worthy of note, yet we often hear features praised, or read of them, which are directly contrary to the customs of every day life.

In every day life we are accustomed to at least the following: first, sufficient ceiling height; second, separate sleeping compartments; third, comfortable beds ready to jump into; fourth, a kitchen with its appurtenances; fifth, room to walk about without discomfort. Each of these features besides many more that speak for comfort, is found on the large motor or steam yachts; and all of them are patterned, as nearly as possible, after conditions as we know them ashore. The success that has been achieved in duplicating home conditions on some of the larger vessels is remarkable.

But it is not necessary that the boat be so very large in order to obtain the comforts mentioned above. Where there are but two in the family who are living aboard it would seem logical to have one entirely separate stateroom for guests, just as it is the custom to have the spare room at home. This can be done with entire comfort on a boat no larger than 35 feet. Suppose, however, there is a family of six who are planning to live aboard and cruise all summer. There undoubtedly will be friends along, for part of the time at least; and it is presumed that a paid-hand or engineer will accompany them, as well.

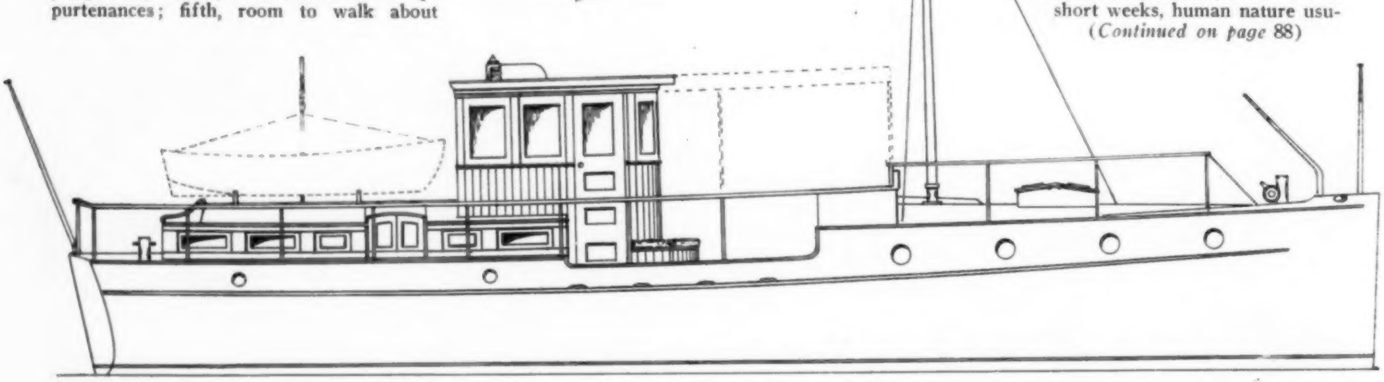
To provide accommodations for such a crew of the nature already mentioned, would ordinarily require a 60- or 80-footer; yet, with a little judicious planning, real comfort may be obtained on a length no greater than 42 feet. But besides comfort we want a boat that presents a fair appearance, for unquestionably there is a lot of satisfaction in just merely owning a boat that you need not be ashamed of, regardless of what harbor or what company you are in. Furthermore the boat should possess sea-going qualities.

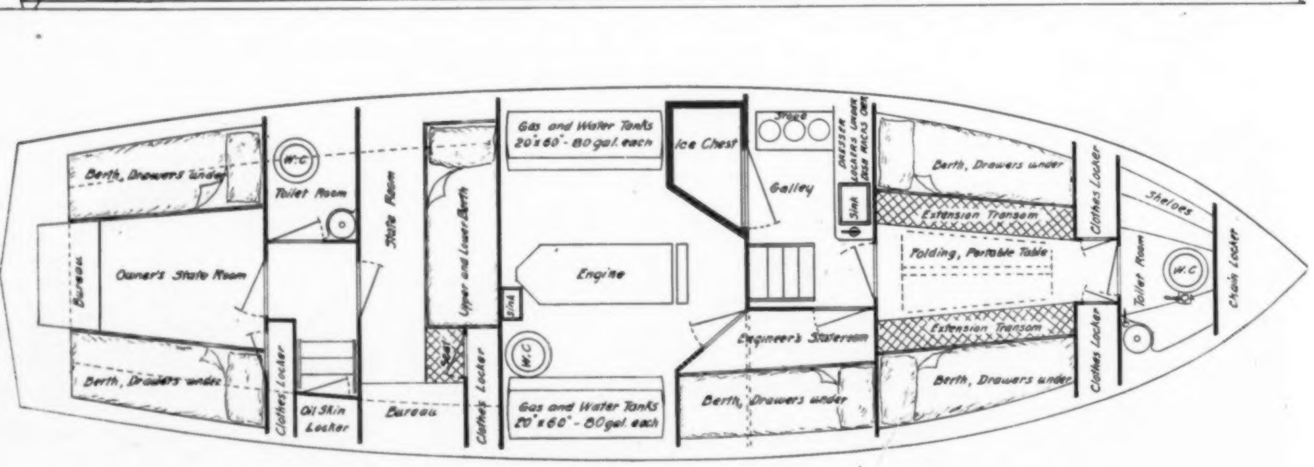
By referring to the accompanying drawings it will be observed that all of the features already enumerated are present. While the boat can hardly be called a beauty, as the term is applied to some boats, yet she is well balanced as to proportions. Even with the pilot house there is a symmetry of form which gives her a business-like appearance. Moreover, the absence of freakish details is noticeable.

To take up the several points in the order already given, it will be noted that every sleeping compartment—and there are five of them—has full headroom. Now, the only unusual feature here is that the paid-hand also has headroom. Instead of being obliged to be shipmates with a smelly old engine or two, down in a more or less congested engine compartment, with his berth slung over one of the gas tanks, and with no more than 4 to 5 feet under the deck beams, he has a stateroom all to himself; just like regular folks. On many 50- or 60-footers, even, the poor engineer is obliged to bunk in quarters like those described.

While some people advocate just one big commodious cabin, this in reality is an unwise and sometimes dangerous policy. It is all right for a while; but with a lot of folks living on a small boat, even for two short weeks, human nature usu-

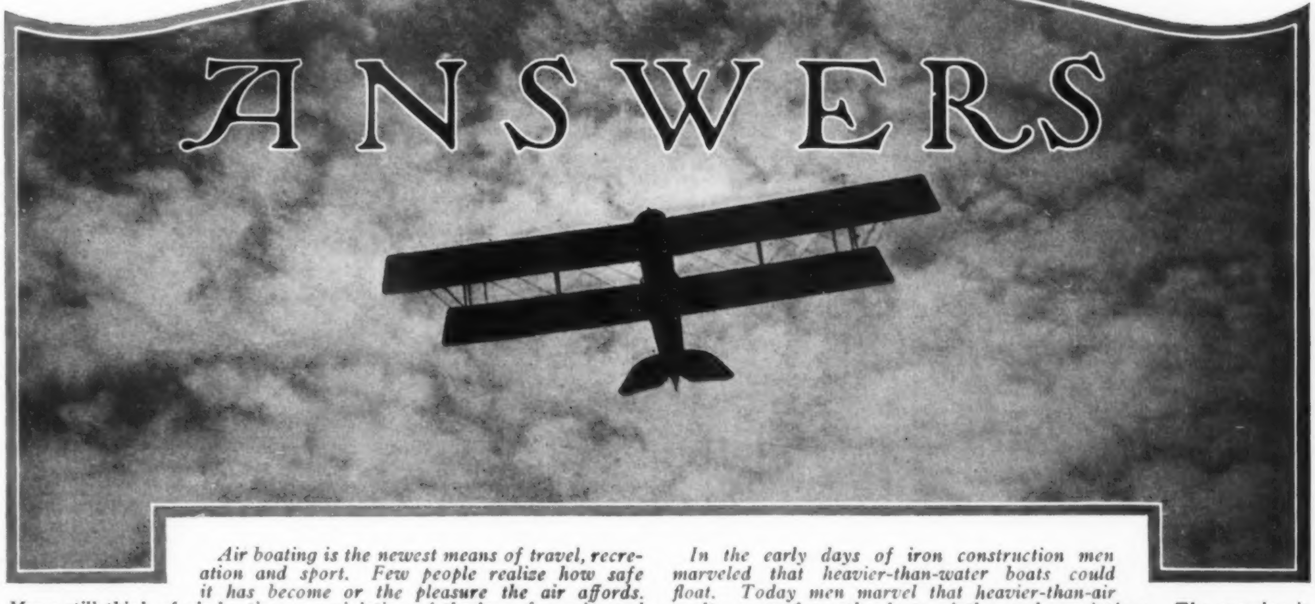
(*Continued on page 88*)





A 42-footer with real comfortable sleeping accommodations for ten or eleven persons

ANSWERS



Air boating is the newest means of travel, recreation and sport. Few people realize how safe it has become or the pleasure the air affords. Many still think of air boating as a violation of the law of gravity and therefore "Tempting Providence." Some approve it—for others, but will have none of it themselves. Still others, satisfied that it is safe, take only a casual interest for lack of definite information.

We believe that air boating should and soon will be as popular as motor boating is to-day. Many who now for the first time take any serious interest in the air will float upon and glide through it with as much satisfaction and perfect security as speeding over the water.

In the early days of iron construction men marveled that heavier-than-water boats could float. Today men marvel that heavier-than-air craft can perform the feats of the modern airplane. The wonder is followed by a lively interest and men come to ask questions, and that is the reason for this department.

Perhaps there is no subject upon which the public has so little information. This is unfortunate and we hope to be of real service to our readers. We hope they will ask many questions, and we assure them that we will in each instance endeavor to give them an accurate and satisfactory answer.

QUESTION: How many different kinds of gliding or air-propelled machines are there?

ANSWER: The meaning of your question is not clear. If the following is not the information you seek, try again. The hydroplane glides over the surface of the water by the power of a submerged propeller. The Glisseur glides over the surface of the water by an air propeller. The hydroaeroplane (or hydroairplane) starts from and alights upon the water by means of floats or pontoons, but is designed for air flight. Merely adding pontoons to a tractor in place of wheels gives the hydroaeroplane.

The flying boat starts from and alights upon the surface of the water by means of a boat body, but is designed for flying in the air. The aeroboat (or airboat) is primarily characterized by a staunch boatlike body, around which the rest of the airplane is built. The Owl is designed for starting from and alighting on either water or land and is equipped with both pontoons and wheels. The airplane is designed for starting from and alighting upon terra firma only. It will be observed that all but the first two mentioned, the hydroplane and the Glisseur, are aircraft.

* * *

QUESTION: What is the legal right of an aviator to constantly cross and recross the property of his neighbors in "taking off" or returning to the hangar?

ANSWER: According to the old common law a man's rights are from the center of the earth under his property to the heavens above, and hence anyone flying over it is termed a trespasser. Some few towns also have ordinances which prohibit flying over their limits. The rights of the airplane, however, have not yet been definitely decided in law. This is probably because of the fact that it does not proceed along highways and therefore does not conflict with the predetermined rights of others. Anyone who damages the life or property of his neighbor would, of course, be accountable to the extent of the damages, and we can readily see how damages may result from emergency landing in cross-country flights. This problem will doubtless be cared for with the development of aviation. The writer has no fear of anyone being able to enforce the exclusive use of all the air above his property, although some may desire to make such a claim. When, however, the airman lands in a place to which the public has access and damages some person, his liability is defined by common law.

QUESTION: Will the conclusion of the European war throw a lot of valuable planes on the market?

ANSWER: Perhaps many planes will be available, but we must always remember that the planes made for war work are highly specialized machines. In some, stability has been largely sacrificed to speed. In fact, some of the speediest planes are now so delicately constructed that an inexperienced pilot by failure to handle them exactly right would break the machine in two in midair. Some have practically no factor of safety. We are of the belief that most American aviators will want their own machines made at home after a carefully selected plan and for a definite purpose. The Post Office Department is now planning to utilize all aircraft that has become too antiquated for further war use.

* * *

QUESTION: In the February issue of AIR BOATING you treat the subject of aircraft as though airships, or navigable balloons, were of very small importance. Why is this? The development of the airship is the result of a long period of research by patient scientists.

ANSWER: We do not mean to slight the airship. It is true that its development has spread over a far longer period than in the case of the airplane. However, the greater cost of experiment with airships and the enormous amount of material one contains compared with the material in a number of airplanes able to carry an equivalent load, together with its short life, are a great drawback to the airship's use in war. Within limitations, however, they have certain advantages over airplanes. They are less likely to be compelled to make sudden descents and are therefore specially adapted for cruising over the sea. They can carry heavier loads per horsepower than the airplane can at this time. They can remain aloft for longer periods of time and can hover longer over a particular point of enemy territory. They can also hide very effectively in cloud banks.

* * *

QUESTION: What is the most important branch of the air service? I mean, what is the most important use to which aircraft are put in war service?

ANSWER: The reconnaissance plane is most important to the army or the navy. The airplane is, in fact, the eye of the Army and Navy. It is by means of these eyes that the enemy's guns are located and silenced. But the reconnaissance or scouting plane is promptly attacked by the battleplane, and we must have battleplanes with which to defend our own scouting machines and to attack the enemy's. Of course, scouting planes are very light and, though speedy, cannot be used to carry loads, and so the bombing machine developed.

The scouting and reconnaissance planes, however, are today absolutely essential to any military or naval activities.

* * *

QUESTION: What are the specific reasons for the preference in warfare for the airplane over the dirigible?

ANSWER: In considering the relative merits of the two aircraft: two important questions are involved:

1. Their merits for the primary work of the air service *i. e.*, reconnaissance, attack, and defence; and
2. Their relative power of mutual destruction.

In all our study and consideration of this subject, we must bear in mind, the present stage of aeronautical development.

Reconnaissance, the primary work of the airplane, demands great speed, and speed depends on two important things, which are the airplane's lightness and its low resistance to the air. It is obvious that in the dirigible we have the least weight relative to the air. It is equally obvious that we have in the dirigible an air resistance that puts it far below the airplane in speed attainments.

When we come to duration of flight and ability to remain aloft, the dirigible is far superior to the airplane.

It may be that later developments in air warfare will utilize the dirigible to a greater extent, on account of its ability to stay aloft, but so far airplanes are in demand for their primary use, reconnaissance. Furthermore to date the airplane bids fair to maintain its preeminence over the dirigible.

* * *

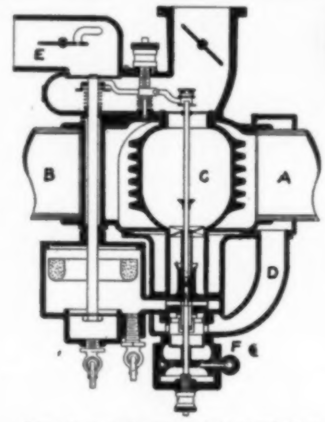
QUESTION: What arm of the military service will eventually find its work reduced by the activities of the airplane.

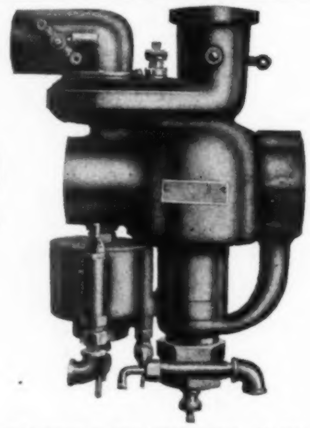
ANSWER: We cannot say. However, the work of the air service is more closely allied to that of the cavalry than to any other arm of the service. In fact, the cavalry as the most mobile, has heretofore been the most used for reconnaissance in previous wars, and is today in the present conflict still greatly in demand for rush work. It will perhaps always be employed regardless of the number and efficiency of the airplane. It is impossible to draw final conclusions at this time.

New Things for Motor Boatmen

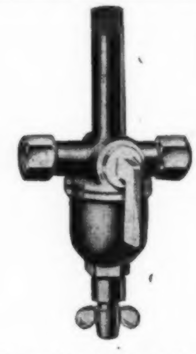
[Each month new parts, attachments and fittings, interesting and invaluable to owners of large and small motor boats, are added to the devices already on the market. Announcements of these articles come to us in such numbers that in order to introduce all of them to our readers we have been obliged to omit descriptions and publish only illustrations with short explanatory captions. In doing this, however, we urgently invite our readers to write us for complete information, as we shall take the greatest pleasure in providing it, together with the manufacturers' names and addresses. Do not hesitate to ask us, as we have made special arrangements to take care of this branch of our correspondence and are able to give you accurate information with the greatest promptness.]

This device will replace three fittings ordinarily used on the gasoline line—a shut-off, strainer, and reserve supply feature. The gasoline is ordinarily drawn through the upright tube, but should the supply become low the other shut-off is opened, drawing the gasoline from the bottom of the tank. A strainer is enclosed in the body of the device and a ground-joint drain cock at the bottom





Here is a carbureter that should interest every motor boat owner. It can be used for gasoline or kerosene or both, and also provides the necessary amount of water for the complete combustion of kerosene with each charge of this fuel. Hot gas from the exhaust is taken in at A and discharged at B heating the chamber C through which the mixture passes. Warm air is drawn in through D and E if desired. A fresh water supply is connected at F



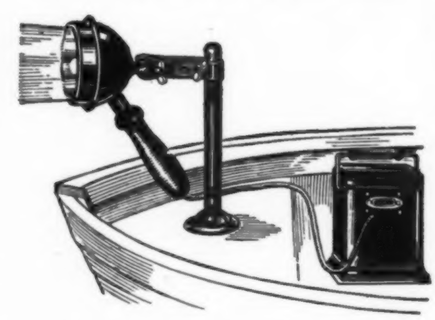
Those who wish to use both gasoline and kerosene in their motor will appreciate this device. It is connected to the carbureter, and either fuel is drawn at will by simply turning the handle one way or the other. When in the position shown the fuel supply is entirely shut off. A strainer is enclosed in the body and a ground-joint drain cock at the bottom provides for cleaning the strainer of sediment and water

Here is a pump that combines the advantages of a force pump and the price of an ordinary bilge pump. The body is galvanized iron, of large diameter, with brass stuffing box for the rod. The nozzle is made on a taper so that any ordinary size of rubber hose can be slipped on over it and deliver the water over the side of the boat

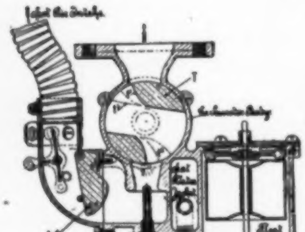
Every one knows how difficult it is to slip a cylinder down over a piston; the rings are always in the way. This piston ring compressor will hold the rings into the grooves and at the same time will slide down the piston as the cylinder is slipped down over it, keeping the rings compressed until they enter the cylinder bore. It is made in three sizes for pistons from 2 to 6 inches in diameter

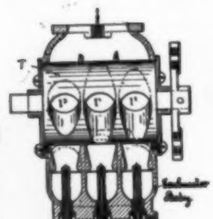
A swivel link for chains that needs no shackel. The chain is put into the eyes, which are then hammered shut and the swivel completed by closing the ring about the ends of both eyes. These swivel links are made in three sizes

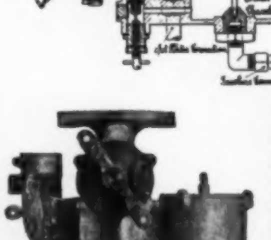
With these terminal clips it is not necessary to remove the nut or screw to attach the wire—they are hooked around the screw. Either the clips or the battery connector complete as shown can be obtained



A real searchlight for the small boat. This lamp will throw a beam of light a considerable distance ahead of the boat. It can also be used as a trouble lamp by removing it from the bracket. It is designed to operate on ordinary dry batteries that are contained in a specially made metal case

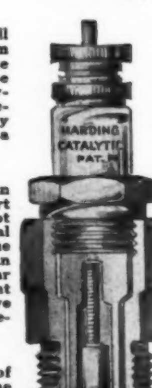






This multiple-jet carbureter is somewhat different in design and operation and embodies a number of unique features. As the cylindrical throttle T is opened it brings the low-, medium- and high-speed nozzles successively into action, thus assuring maximum economy under all conditions. Each nozzle is provided with a needle valve for regulating the flow of gasoline, and a hot water jacket is included in the body of the carbureter

A life preserver garment that can be worn constantly with comfort and convenience as it does not hamper the wearer in his normal movements, while at all times he is prepared for an emergency. An important feature is the collar which contains sufficient buoyant substance to keep the head above water even though the wearer becomes unconscious



A spark plug that is kept free of carbon by catalytic action. The carbon that is deposited on the exposed end of the porcelain core is burnt off by a catalytic or flameless combustion by the fresh charge of gas on the compression stroke

Do not fail to write to the editor if you desire information concerning any of the above new things

Aviation in the Far Corners of the World

(*Continued from page 17*)

in the country were taken up by the Government for the German South West African campaign that started in December, 1914. The Germans in the late German South West, now South West Protectorate, had a machine attached to their forces. It did some damage by flying over the camps of the British South African troops, plainly visible in the sandy desert, and dropping bombs. The German aviator took one very interesting picture of this bombing from his machine. It is published on page 17.

Then hostilities started in German East Africa, and the forces from England brought with them several airplanes that did great service in helping to locate the enemy in the thick bush that covers most of that country. The Germans had an airplane here, too, but the aviator was forced to descend at the Salita Hill fight a few months ago, and he burnt his machine. A picture was taken by one of the South African Signalling Corps and it shows the machine lying all charred and useless, but still preserving the shape of a pretty good airplane.

There is a little incident of interest attached to the photographing of this machine by the signaller. With several of his fellows he was near it in the Salita Hill fight when an order came to take up another position, and they had to run for it through a hail of bullets. But the temptation to take the picture was too strong for the man with the kodak, and he stopped. He was being fired at all the time, and says he felt shaky, so that the result was a surprise to him. He got a remarkably good picture, although he never expected to get anything as he was in an excusable hurry.

The latest flying-man to come and delight peaceful British South Africa is Major Millar. But he didn't come to exhibit for fun. He has come to recruit, flying over various parts of the country. He has demonstrated to the youth of the country the wonder of flying and recruited as many as can be attested by the authorities. Boer and Briton alike have flocked to the recruiting depots to try for the Royal Flying Corps, and Millar has certainly obtained the best of the country's young manhood.

He has flown over country parts of South Africa where an airplane has never before been seen. He says that as he passed over the ox-wagons on the roads their drivers would stop and stare at the great bird far above, and drivers of railroad trains would set their locomotives whistling away at sight of him. And as for the natives—the Zulus, Swazix, Basutos, and other practically uncivilized tribes, the black inhabitants of the country—they would not worry so much as the Boer farmers as to the cause of the great bird above. They just put it down to "M'tagati"—magic—and never worried further simply considering it another of the white-man's miracles. For what could be more wonderful than the "wagons that go without oxen"? (The automobile and railroad train).

The writer was standing in a Johannesburg street trying to get a picture of Major Millar as he circled above when he overheard a Zulu woman remark "M'tagati" and just continue staring up in an ordinary interested sort of way, while some of the city's white inhabitants who had never seen an airplane before showed wonderment plain on their faces.

Of course quite a lot of good stories have come in from the country about Millar's flights, true for the most part, but exaggerated. One native boy (all the black males are called "boys" in South Africa, whether they are six or sixty) went running to his boss to tell him that his windmill was flying away with two men on it. And the boss, an uneducated Boer, had a look, then took his pipe out of his mouth, spat, and in Dutch told the boy not to be several kinds of fool, as it was only a vulture flying low! Certainly a vulture with its grand wing-spread does not look unlike an airplane.

Motor Boats Hunt the Huns

(*Continued from page 7*)

of the enemies' guns without the loss of a single motor boat. Two of them came out of the harbor with 200 men taken from the ships under fire.

During the time the block ships were being run up to the canal, a fleet of motor boats armed with guns and torpedo tubes cruised about the harbor, attacking and sinking every boat encountered. The damage inflicted on the enemies' craft by the motor boat fleet included at least two destroyers, a number of submarines, a dredge, and the old British railway ferry Brussels that was being used as a torpedo training ship.

Although it may not seem of importance at first thought the destruction of the dredge was of considerable military value. The Belgian coast is all sand, almost continuously kept in motion by the tides and currents. This moving sand is deposited in the harbors and channels, making continuous dredging necessary to maintain any depth of water.

Aerial observation has shown that a break of at least twenty yards was opened in the mole by the exploded submarine, and through this gap the drifting sand will have free access to the harbor.

When the landing party was recalled by the Vindictive's siren a number of men were unable to reach the cruiser in time. After completing the destruction of the guns and stores, these men, stranded on the mole under fire of the shore batteries and machine guns, were taken off by motor patrol boats.

During the entire operations the fleet was guarded against a surprise attack by the enemy destroyers by motor picket boats, each patrolling an allotted course off the harbor. It was some of these patrol boats that picked up the crews of the submarines blown up at the mole and rescued the men left ashore by the Vindictive.

While the operations at Zeebrugge were in progress, another fleet attacked Ostend. Here the smoke screen was spread along the coast, but at the critical moment the wind shifted and blew it off shore, revealing the attacking squadron.

An attempt was made to carry out the operations but the Stroom Bank buoy marking the entrance had been moved. The concrete laden Sirius headed for the channel but, misled by the buoy, grounded some 2,000 yards off the entrance and was sunk to avoid capture.

There is no doubt but that the closing of the canal at Zeebrugge put the Huns on their guard against the repetition of such an exploit. They removed the Stroom Bank buoy entirely. They cut gaps in the piers forming the harbor entrance as a precaution against a landing, and they had nine destroyers on patrol.

Under these conditions it was evident that a second attack on Ostend must be a complete surprise or result in failure. Possibly even more disastrous than the first.

In the early morning hours of May 10, a fleet of motor boats and destroyers quickly and successfully spread a smoke cloud off the Ostend coast. The motor boats running well in shore through the shallow waters. This time the smoke cloud resembled a natural sea fog so closely that no suspicion was aroused.

Behind this screen the destroyers, monitors and patrol boats took their allotted stations. No chances of missing the channel were taken this time. A motor boat ran in through the smoke, hung a flare on the wreck of the Sirius, providing an unmistakable beacon to guide the larger ships.

The Vindictive, now loaded down with concrete, slowly approached the harbor through the smoke screen, accompanied only by a fleet of motor boats acting as guides and spreading a smoke cloud as they proceeded.

Fifteen minutes before the Vindictive was due in the harbor the signal for the guns to open fire was given. Here the surprise ended. The big naval guns on shore mounts over in Flanders and those aboard the monitors spoke at the same time, while the airplanes aided in the destruction by dropping bombs on the enemy guns.

As the bombardment started two motor boats ran in at express-train speed, torpedoed the ends of the piers, destroying the machine guns, then dashed out to sea, all under the glare of searchlights and star shells, and without a single shot in a vital place.

When the Vindictive neared the entrance to the channel, a motor boat with a flare took its station on the site formerly occupied by the Stroom Bank buoy, and laid to, under concentrated fire, until the cruiser was safely on its way in the narrow channel.

Just about this time a real sea fog blew in, dimming the light of the star shells and searchlights. To avoid any chance of having the Vindictive miss the narrow harbor entrance a motor boat ran in between the piers, within a few yards of the German guns and planted a flare right in the center of the 350-foot wide channel.

The Vindictive, now the target of nearly every gun on shore, steamed right over the flare and up the narrow entrance. When over 200 yards up the entrance an attempt was made to swing the ship across the channel.

Being heavily loaded with concrete, she grounded and had to be sunk before the channel was completely blocked. As the ship settled to the bottom several motor boats ran in alongside and took off the crew. As at Zeebrugge, this was a most difficult piece of work right in the thick of the machine gun fire, and most of the casualties were incurred while the ship was being abandoned.

Although the concrete filled cruiser sank at an angle of about 40 degrees with the channel and did not close it completely, a ship of that size sunk in a channel about 350 feet wide does not leave much room for other vessels to pass it. It is believed that the part of the channel still open will rapidly silt up, effectively closing the harbor.

Both Zeebrugge and Ostend are connected with Bruges by canals, a ship canal from Zeebrugge and one for smaller craft from Ostend. With both canals blocked, all three cities, together with the docks, yards and shops, are rendered useless as submarine bases. Dredging operations and work on removing the wrecks from the channels is practically pre-

(*Continued on page* 86)

The Air Pilot's Story

(*Continued from page* 15)

is calm, all I have to do is rise, point northeast by compass, and fly a little over four hours (at 55 miles an hour) to get there.

"But the anemometer tells me the wind is blowing 20 miles an hour a little north of east. I assume that at 3,000 feet—which is the height I propose to fly—it will be at least 38 miles an hour, and somewhat south of east. I have, then, to lay off a course to fly which will carry me as much north of east, at 35 miles an hour, as the wind will carry me south of east at 38 miles an hour. I want to know, too, the compass bearing of this course, I want to know the speed I will make, and I want to know how long it will take to get to Journeysendburg, because if I don't know all these things I may either not recognize landmarks from my chart or, worse, I may 'get off the chart' altogether. You know the chart we use for a journey of that kind may be a long strip on rollers. Our flight path is plotted on it in a straight line, even though we make some corners (to catch sight of well-known landmarks, or avoid a known bad landing area or a lake or something like that)! If I 'get off the chart' without knowing it (as I might do in a fog or above the clouds), I am as much lost, half a mile from the earth, as if out of sight of land in a rowboat with no compass or sun to guide me. Then I must come down to find out where I am.

"But to get back to my little navigation problem. It sounds worse than it is. I draw a line on the chart connecting Landingville and Journeysendburg. This is the line I want to follow. Then, from Landingville, I lay off a line parallel to the direction of the wind—in this case, south of east. With the dividers, I lay off thirty-eight miles on this line, according to the scale of the map. Call this point A. With this point as a center, I describe an arc of a circle, the radius of which is fifty-five scale miles. This arc cuts the line between the two towns at a certain point. Call it Point B. Point B is the distance I will make from Landingville in one hour, in a 38-mile-an-hour wind of the direction plotted, if I fly on a course the compass direction of which is from point A to point B.

"The compass direction of the line from point A to point B is the direction in which I must fly to get to Journeysendburg—a seeming anomaly, that I point in one direction and go in another, but not an actual one, any more than it is anomalous for a boat to steer a little south of west when trying to hit the Atlantic Coast at a given spot and running through the Gulf Stream which carries the boat slightly to the north.

"The distance from Landingville to point B is the distance I will fly in an hour—that is, my own speed, decreased by the amount I must fly out of my course to counteract the wind and increased by the amount which the favorable component of the wind lends to me. In this case it will make my speed 72 miles an hour, since the wind is more fair than foul. Then I know that I will arrive at my journey's end in 3 hours and 8 minutes, and I can divide my chart up roughly into sections, and will know about when to look for any prominent landmark, such as a town, or railroad or lake or similar easily recognizable object."

"But you can't be sure that the wind is 38 miles an hour 3,000 feet up, that it won't change its course or that it will keep to the compass direction you have assigned it on your chart," injected the Honorary Member.

"Certainly not. And that's where the difficulty comes in. There is a drift indicator which will tell me a little—a telescope pointing downwards, movable in a circle graduated in degrees, with zero and the nose of the plane in line. There is a cross hair in the telescope. By looking down through it, and orienting the cross hair with the landscape so that it is true with the direction of the surface objects apparently sliding through the field of the telescope, I get a degree reading on the scale which tells me whether I am going the way I am looking or not, and if not, how much off my apparent course my real course is. I know before I go up that this reading must be for the particular course I am steering and the direction and velocity of wind I count upon, and if it differs, I know that the wind has changed, either in direction or velocity."

"But how do you manage when you are flying overseas? Suppose you are at New York and there is a battleship 200 miles at sea of which you know the latitude and longitude? How do you reach it?"

"That's the question!" laughed the pilot. "We don't know. We can lay out our compass course and calculate on the wind and the direction and all that. But we can't recognize waves or fishes as landmarks, and if the wind changes aloft while we are going, and we get miles out of our way, why—there we are! However, flying at a height, one can see a long, long way on a clear day, and even if we miss the battleship by miles, we can usually see her in time to come down. But finding location at night, in a fog, over the clouds or over a blank sea, is one of the problems aerial navigation has yet to solve."

"Why, can't you tell if the wind changes by the feel of it? I always can!" The commodore spoke before he thought.

"Because the wind is your motive power. You move slower than the wind. Any change is immediately perceptible. But a plane moves through the air at whatever speed she goes, regardless of the wind. I go just as fast in a 35-mile gale as in a dead calm, and no faster, as far as the air is concerned. It feels just the same to bore at 70 miles an hour into a 70-mile gale (supposing I did such a thing!) which would keep me absolutely stationary with regard to the earth, as to turn tail to the gale and fly down it at the same speed, which would give me a speed of 140 miles an hour with relation to the earth. Of course, if I am flying along in a calm, and suddenly run into a strong side wind, I feel it, at once, and the machine either dips or rises and tends to turn. But as soon as she is adjusted to the new condition, it

(*Continued on page* 86)

Motor Boats of the Pacific

(*Continued from page* 32)

cial motor boating on the Pacific Coast has proved very interesting to those who have followed each stage, and that is the gradual growth of individual fleets in the various marine centers. Of these individual fleets, there should be mentioned those of Roy Lillico, at Seattle, the Foss flotilla at Tacoma, Cousins at Newport, Coggeshall at Eureka, Crowley at San Francisco, Peterson at the same port, Oakland Launch & Towboat Co., at Oakland, Blossom at Stockton and Young Brothers at Honolulu. Most of these fleets started with one small motor boat. Now some of them number nearly fifty. Many of their craft are the very last word in present-day motor boats of their type.

• • •

Let Loose the Gulls of War

(*Continued from page* 19)

neighborhood of the leading Atlantic ports. The decrease of the ocean passenger service has cut off bounteous rations from them, and even the large quantities of rejected food from the city are no longer as extensive as they used to be, before the coming of conservation. Therefore their appetites ought to be very good, if the inventor is enabled to carry on further experiments with these living hydroairplanes.

It was owing to the value of the gulls as sanitary police that they have been extensively protected in this country. The National Association of Audubon Societies brought about the passing of the laws which forbid the destroying of the eggs of the gull or the slaughtering of the grown fowls for their plumage. The fact that so many of the winged aids to municipal health exist now and are flying about these shores is due to a long sustained policy of the champions of bird life.

The harbor of Rio Janerio is one of the best examples of the use of the gulls as servants of the city, for it is kept clean by the many thousands of these creatures. That wonderful summer resort, Bar Harbor, represents an appreciation of the value of the gull. The original town was a mile or so away, and had become untenable because of the slaying of the gulls which ate up the refuse from the fish packing houses. So the selectmen finally abandoned the place, sought another location and started that movement which has made the gull one of the most highly respected residents of Maine.

Although the gulls are usually referred to as busying themselves over the sea, they are often just as useful on land. The gull monument, modeled by Mahonri Young for his Utah brethren commemorates the saving of the crops of the Mormon pioneers from the plague of the grasshoppers and the locusts which were about to lay waste their lands. The gulls seeing the insect swarms afar off descended upon them and soon destroyed the pests.

Some one has compared the hosts of the German drive to hordes of locusts. In that case, the swift flying birdmen, in their high-powered battleplanes, should be able to do as effective work with the swarming Hun, as did our natural aeroplanes against the crawling hordes which so nearly overwhelmed the land.

Both as conservators of crops in these days when food will help in the winning of battles, as well as air patrols, these birds have their mission. Wherefore, let us let loose,—the gulls of war.

Creating Life Artificially

(*Continued from page 27*)

fusion in a suitable medium. Figure 1 is an example of this. Here we have a pattern produced in gelatine by the diffusion of drops of silver nitrate and sodium carbonate. These drops immediately diffuse through the gelatine, forming the beautiful figure here seen, which is certainly as complicated as many crystalline and organic bodies. If "God geometrizes," we see that it is due to the fact that certain physical and chemical forces are at play, which we can ascertain and experimentally duplicate.

Shells are substances we might expect to see duplicated by chemical means—since they always appear to us dead mineral matter; yet they have been formed by the living creature within them, and might be considered a part of its "life." The almost exact duplication of various forms of shells, by osmotic pressure, is seen, however, in the photograph (Figure 2), which illustrates the experimental duplication of these growths.

The next illustration (Figure 3) is far more striking. Here we have a series of chemically produced fungi, or mushrooms, which certainly resemble the originals too closely as to be mistaken for them at a casual glance. Yet they were all produced by means of chemicals and water—by osmotic pressure—and by varying the density or concentration of the solutions used.

Figure 4 is even more striking. Here we have a cluster of well-defined flowers, growing upon slender and well-formed stems. These flowers grew to a height of more than 18 inches, and the flowers proper were of varying and beautiful tints. They were, however, quite different in structure and in coloring from the stems on which they grew. These certainly resemble flowers very closely, and are a striking illustration of the great similarity between natural and artificial growths.

It must not be thought that the stems on which these chemical flowers grow are mere tiny pillars of salt. A microscopic examination of their structure reveals the fact that they are truly stem-like in their formation, closely resembling the bamboo and many other plant-stems in their method of growth. A micro-photograph, showing the structure of a number of these osmotic stems (Figure 5), will make this clear.

When, now, we place together a number of these osmotic, or chemical and artificial growths, we have in very truth a garden, formed in this extraordinary manner (Figure 6); and here we apparently have growing together shells, fungi, flowers, plants, etc., in profusion and great variety. This is surely a striking result, one calculated to bring home to us the very close resemblance between real and artificial growths between the living and the non-living.

Osmotic growth is accomplished by means of osmotic pressure. If a highly concentrated solution, contained in a natural membrane of some kind, be placed in a thin or less concentrated solution, the former has a tendency to expand or grow, and this growth is proportioned to its own internal pressure. By manipulating the concentrations of the varying solutions, almost any degree or growth, or any shape desired, can be obtained. Although this process is purely artificial, may we not assume that very much the same processes have been active in the formation of true organic growths, which are supposed to have grown up under the influence of life?

If it could thus be shown that osmotic growth plays a real part in the formation of apparently living or growing things, and so closely resemble them, this would assuredly turn out to be of interest not only for biology, but for paleontology and geology as well.

In all that has gone before, however, it may be said that none of the higher life phenomena have been shown to be duplicated. After all, there is a tremendous difference between the production of shells and fungi and living, human, organic forms; and that, while it is conceivable that these lower forms might be created or governed by the physico-chemical phenomena described, it is not credible that higher life phenomena are also thus governed.

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Creating Life Artificially

(Continued from page 60)

In short, the old differentiation between living and non-living is still said to hold good.

Living beings are built up of cells; which multiply by division, and depend upon nutrition for growth, and until these cells have been duplicated in their actions, their development and method of reproduction, it is premature to speak of the artificial duplication of life phenomena.

Now, however, we come to the most striking experiments of all, in which Dr. Le Duc succeeded, apparently in duplicating, almost exactly, the precise details of cell-division, known as karyokinesis, which have always been considered examples, par excellence, of life or vital phenomena. Yet they have been duplicated by means of osmotic pressure, in great detail, and with striking similitude.

When a cell divides, and multiplies into two cells, the process is somewhat as follows. In the center of each cell is the nucleus. This is full of thread-like material known as chromatin. To one side of the nucleus is a tiny polar body, known as a centrosome, which seems to send out lines of invisible force, like a magnet. Now, this centrosome divides into two; these two move round until they are on opposite sides of the nucleus. Meanwhile, the thread-like chromatin has bunched itself together into more solid and less numerous bodies known as chromosomes. These latter range themselves in two straight rows—apparently under the attractive influence of the centrosomes. They split across their centers, and are drawn to the centrosomes. When nearly there, the cell divides across the middle, and two new independent cells are formed—this process being kept up, apparently, forever, or so long as life and growth are maintained.

Now, this whole process is very strikingly duplicated experimentally by means of diffusion (see Figure 7). Here we see the central, nucleus-like body, composed apparently of thread-like chromatin, and the two star-like centrosomes. These latter seem to exert an attractive force upon the central mass; the threads begin to divide in the center, and a complete division is effected in photograph C. Then, finally, we have two cells in juxtaposition, each with its nucleus, its protoplasm, and its enveloping membrane.

Here, surely, we have a very close approximation to life phenomena in its most detailed and intimate form. Indeed, we might perhaps legitimately go further, and say with Dr. Le Duc: "Without attaching to it an importance which is not warranted by experimental results, it is interesting to note that we have here two methods of fertilization—by centrosomes of greater concentration and by those of lesser concentration than that of the plasma of the ovum, and that we have in nature two corresponding results, *viz.*: two different sexes. It is possible that we have in these two methods of producing nuclear divisions the secret of the difference of sex."

At all events, it has been shown that these osmotic growths imitate very closely the process of life, of the organic world, and open a new chapter in the experimental demonstration of similar mechanisms or modes of life. As Dr. Le Duc concludes his remarkable monograph in the following recapitulation, we cannot do better than do likewise, thus summarizing the close resemblances between living beings and these osmotic growths, and bringing before us vividly the significant fact that life, or rather living things, may perhaps after all one day be artificially created. He says:

"Let us briefly recapitulate. An osmotic growth has an evolutionary existence; it is nourished by osmosis and intussusception (slipping of one part into another); it exercises a selective choice on the substances offered to it; it changes the chemical constitution of its nutriment before assimilating it. Like a living thing, it ejects into its environment the waste-products of its function. Moreover, it grows and develops structures like those of living organisms, and it is sensitive to many exterior changes.

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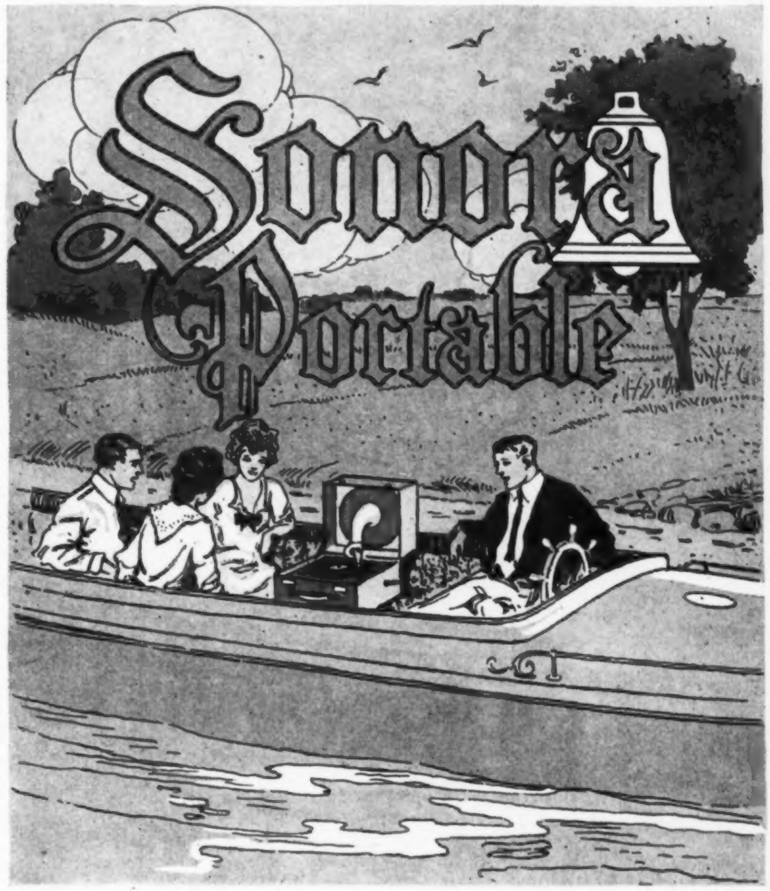

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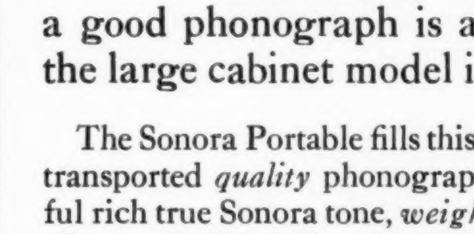

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Building a War-Time Knockabout

(*Continued from page* 43)

convenient place to store the anchor, rope and other gear. A slatted floor in this space made by fastening strips across from one bilge stringer to the other will be a great convenience in keeping the contents out of the bilge water.

The floor is carried on $\frac{7}{8}$x$2\frac{1}{2}$-inch beams which in turn rest on the bilge stringers as shown in Fig. 1 and Fig. 2. The flooring should be $\frac{7}{8}$x3-inch white pine dressed and edged but not matched. This should be laid with a space between the boards to prevent buckling when wet. The three middle boards should be nailed to cleats so that they are removable for pumping out the bilge, recovering lost articles, etc.

The Rudder

The rudder is to be made of $1\frac{1}{8}$-inch oak, the two pieces being held together by 5/16-inch galvanized iron rods as shown in Fig. 1. After the pieces have been fastened together, the rudder is planed to a taper so that the after edge is only $\frac{7}{8}$-inch thick and the forward part brought to quite a sharp edge where it is cut away for the wheel. It is to be hung onto the transom by regular rudder gudgeons with long straps and also to the skeg in the same manner. The two upper gudgeons should be of the double eye type with a galvanized rod run through both. The lower eye on the transom being above the eye on the rudder, and the upper eye on the transom being below the eye on the rudder.

The tiller is made of galvanized strap iron $\frac{1}{8}$x$1\frac{1}{8}$ inches bent around the rudder and riveted together at least at three places inside the boat and fastened to the rudder by two bolts through the whole thing. Bore two holes through the inner end for the tiller rope about 18 inches from the edge of the rudder. Blocks should be nailed to the deck beam so that the tiller cannot turn more than 50 degrees either side of the center.

The Fuel Tank

When it comes to purchasing the fuel tank, get the best one you can afford. The galvanized seamless steel kind generally give the best satisfaction. The tank shown in Fig. 1 is 14x24 inches, holding sixteen gallons and will be amply big for a 5 h.p. motor. It is held to the deck by two galvanized iron straps and sets in chocks on the chines as shown in Fig. 2.

The filler pipe should be provided with a brass deck-plate of the type that screws fast to the pipe. This prevents spilled gasoline getting into the boat when filling the tank. The pipe to the motor should be 5/16 or better yet $\frac{3}{8}$-inch O.D. copper tubing, run along one side preferably on top of the chine. Don't run it in the bilge—it's dangerous. Use a good gasoline cock or a globe with a ground union right next the tank and another at the carbureter. Have no joints in the gasoline line between these two fittings, and solder the tube fast to the union. Flanged or compression couplings are all right—but they have been known to work loose. In making turns always bend the tubing to a large radius, and don't figure the length so closely that you almost have to stretch the tubing to make it meet at the ends. Have some slack to spare. You cannot be too careful about this part of the work. Remember that the majority of boats lost by fire can trace the cause to a leak somewhere between the tank and the engine.

Hardware and Fittings

Use large diameter galvanized sheaves for the tiller rope at the corners of the transom and also at the forward bulkhead. The ordinary galvanized pulley will cut the rope in an amazingly short time. Use fairleaders along the sides to hold the rope in near the planking.

The steering wheel can be either of galvanized iron or brass, but if the latter, be sure it is heavy. Some are too thin and too small to be of much service. The chocks should be at least large enough to hold a $\frac{7}{8}$-inch rope without binding or jamming and the 9-inch cleat will be none too big. If you use a padlock on the engine compartment be sure it is all brass—inside as well as outside—otherwise it may rust shut and have to be cut off. A Yale padlock costs more but is worth it.

Caulking, Finishing and Painting

The caulking and finishing should be done after all the carpenter work is complete. For a boat this size the most satisfactory material for the seams is caulking cotton. This comes in loosely rolled strands ready for use. Use only a caulking iron with a very narrow edge and do not drive the cotton in too tight, and use a small wooden mallet, not a hammer.

As one strand of the caulking cotton is not enough to fill the seams, it is customary to drive it in as a series of loops. Start at one end of a seam and drive in about 1-inch of the end of a strand, then loop the cotton back and drive in the loop and about 1-inch more, loop it back again about 1-inch and drive it in, the second loop should just overlap the first loop. Continue with this method of looping and driving until you reach the end of the seam. By varying the size of the loops to suit the width of the seam it is possible to have a uniform pressure throughout the length of the seam. The seam along the keel chine, rabbet, and transom should be caulked very carefully so as not to start the fastenings.

When finished caulking the cotton should be about $\frac{1}{8}$-inch below the surface. Now take a sharp plane and smooth up the seams and the whole outside of the hull. Do this carefully as any unevenness will always show more plainly after painting and it is then too late to correct it. Follow up the planing with fine sandpaper.

After the hull has been smoothed up and given the priming coat of paint, putty the seams with either an elastic seam composition or a

(*Continued on page* 88)

Motor Boats Hunt the Huns

(*Continued from page* 56)

vented by bombing from airplanes and shelling from Flanders and the sea.

The American built motor boats that proved such a success in the raids on Zeebrugge and Ostend were the once despied but now thoroughly appreciated ML's, the 80-footers built by the Elco Co., of Bayonne, N. J. The same boats on which all previous construction records were broken. Five hundred and fifty of these boats were built and delivered to the British government ready for use in less than 500 days.

The first few of these boats were completed at Bayonne, N. J., and run to Canada under their own power, then came the cold weather and ice, closing navigation. An attempt was made to ship them by rail, but after eighty-four had been delivered in this manner, it was decided to get out all the parts—every piece entering into the construction—of these boats at the Bayonne plant, fit them, ship them to Canada, and assemble them at yards near Quebec and Montreal.

These chasers are of the raised-deck type, 80 feet long and powered with two six-cylinder 220 h.p. Standard motors. The interior layout provides a chain locker in the forepeak with the crew's quarters immediately aft. The engine-room and galley are located amidship, with the officers stateroom aft.

On deck, a gun is mounted forward just behind the breakwater. The chart house and navigation bridge are just ahead of the break of the raised deck. The after cabin trunk is built so that the roof is level with the raised deck forward.

Without such motor boats as these, capable of a speed of over 19 knots, and able to maneuver rapidly—so fast, in fact, that it is all but impossible to get the range and then hit them with a large size gun, it is doubtful whether such raids as those on Zeebrugge and Ostend could be carried out with success.

Surely the loss of life would have been much greater had they not had these fast motor boats to take the men off the block ships, place the flares, spread the smoke screen and successfully perform the other difficult tasks right under the enemies' guns. It was the speed and maneuvering ability that counted.

The Air Pilot's Story

(*Continued from page* 56)

feels just the same as before, and only observation of the surface will tell me I am not going where I am looking!"

"You can't get much out of observation of the surface of the water!" objected the commodore.

"Not much—but a little," was the smiling reply. "I can fly low enough over water to see the waves and give a guess as to the distances between them. The direction of waves (I am speaking now of waves off shore) is normally at right angles to wind direction. And the distance of wave tops apart is an unreliable but better-than-none-at-all indication of wind velocity."

"Well, why is it necessary to know the wind velocity? Except in cases of extreme winds, your speed is so much greater that I should think you could ignore it." Speed Maniac was still thinking in terms of gas boats.

"So we might, if it wasn't for the fact that we have a limiting factor called radius of action," answered the pilot. "We don't carry gas enough for an unlimited cruise. Of course the gas capacity differs largely with the machine. This thing I'm flying in now has had all kinds of power plants put into it just to see—oh, various things! I mustn't particularize too much or Congress will investigate me and George Creel sit on me! But at present I've a three-hour capacity tank. Calling my speed 75 miles an hour, that means a radius of action of 225 miles. I can go 112 miles out to sea and turn around and come back again. But if I go 120 miles out to sea the only way I'll get back is via a boat!

"This calculation is simple enough—in a calm. But suppose there is an ocean breeze coming in at 40 miles an hour. Obviously, I go out to sea at 75 miles an hour minus the forty the wind is robbing me of—35 miles per hour. And on the return trip I skedaddle home at my speed plus wind speed, or 115 m.p.h. In other words, I come back"—the pilot pulled an envelope and pencil from his pocket and figured an instant—"I come back 3.29 times as fast as I go out. But I want to know how far out I can go and still get back. So I say that the time on the out journey is X and the time on the return journey is X multiplied by 3.29. The sum of the two is equal to the total time—180 minutes—before my fuel is used up. It doesn't take much figuring to prove I can spend 138 minutes going out because I can get home in 42 minutes. My mileage, of course, is 35 miles an hour going or a total of 80.5, and the same returning. And if I don't know the wind velocity or make proper allowances for it, or if it increases largely as I go out, I'm going to land in the water! What? Of course this is theory—no one works on so close a margin, or takes long water trips except in a sea plane or flying boat. But you asked about importance of wind velocity!"

"Well!" The commodore rose and beckoned once more to the white coat. "I know a lot more than I did. And all I can say is that—I'm glad I'm way beyond the age when they draft air pilots! I think I'll stick to two dimensional navigation, thank you!"

"No, you won't!" The pilot smiled, robbing his direct contradiction of any offense. "It's a big thing now—a new thing—a strange thing. But in a few years—maybe less than twenty—flying a plane and running a motor boat, navigating the air and going yachting, will be one and the same thing as far as difficulty or danger or their lack is concerned."

"May I be there to see!" said Wheels. "Here's to the pilot!"

And they drank it standing.

All France Wonders at American Engineers

(*Continued from page* 24)

ing the recent retreat in Flanders the trains carrying both men and supplies were repeatedly under heavy fire. The Germans' advance one day drove the British from a position, obliging them to abandon a supply of shells valued at $200,000. A murderous fire prevented the men from regaining the position. Part of the supplies had already been set on fire, when a daring railroad engineer backed his train through the barrage and sat calmly, hand on throttle, while soldiers put out the fire and loaded the shells on the train. Although the train and locomotive were repeatedly struck the engineer finally brought his train safely to the protection of the British lines.

The fighting qualities of the American engineers at Cambrai are famous. According to the official British report, a force of American railroad men were working in what was supposed to be a safe position when the Germans suddenly advanced on them, firing as they came. The Americans dropped their tools and seized guns. To quote the British officer's own words, "They held on by their teeth until the last moment, inflicting terrible losses on the enemy, when they moved back, waited for the Germans and repeated the operation."

According to the Director General of Military Railroads orders were placed during the first year of the war for 754,000 tons of railroad materials, valued at $142,000,000. This is only a detail, however, of the great enterprise conducted by American railroad men in France.

Building A War-Time Knockabout

(*Continued from page* 84)

mixture of white lead and whiting about the consistency of putty, also fill all the nail and screw holes at the same time.

Before puttying, the sides above the waterline should be given a priming coat of paint diluted with plenty of linseed oil. Finish with three coats of good marine paint. The bottom (below the waterline) should be given two coats of anti-fouling copper bottom paint, the first coat to be applied directly to the wood. This paint will peel off if there is any lead and oil paint on the wood, or any putty along the edges of the seams, have the wood perfectly clean.

The coaming, bulkheads and all interior woodwork should be carefully sandpapered and given a coat of filler. Follow this with three coats of good spar varnish, going over each coat lightly with fine sandpaper before applying the next coat.

The canvassed decks should be given two thin coats of paint. Do not use too much paint on the canvas as it will crack and peel off. If it appears rough after the first coat has dried hard, go over it lightly with fine sandpaper. For the first season the weave of the canvas should show through the paint, but the painting the second season should give a smooth finish.

Nothing will be said here in regard to the installation of the motor, as it will vary somewhat with each make and the manufacturers furnish full directions. Just one word about the ignition system. Stranded ignition wire is covered with better insulation for this service than ordinary electric light wire, it is oil- and water-proof. Keep all wires well up near the deck. Under no consideration run wires under the floor in the bilge. These simple hints will save you from many ignition difficulties.

What Constitutes A Comfortable Cruiser

(*Continued from page* 44)

ally asserts itself and results, sometimes, in a young mutiny. Little annoyances and inconveniences, quite minor in themselves, occasionally become exaggerated, thereby creating friction; and thus proving the soundness of the expression about familiarity breeding contempt. The novelty of roughing it soon wears off, but the desire for comfort is ever present. Therefore, where the size of the boat will permit, segregate the crew and everyone will be happier.

A well-equipped galley is, of course, essential to comfort, but there are two or three other angles from which it should be viewed. To provide meals for a ravenous crew is no small task; so make things as easy for the cook as possible by having the stove, ice-box, sink, etc., of full capacity. The location of the galley is of importance.

To be able to stretch ones legs by taking an occasional turn about deck is not only a source of comfort but a luxury as well. On the majority of small boats, especially of the cockpit variety, there is little room to walk about. We have here, however, a boat where one may take his constitutional in perfect ease. The forward deck, even, provides comfort in this respect, for a railing is provided that is of some real service.

This little vessel should give a good account of herself in rough water. Under such conditions comfort again is provided by means of the pilot house. This is of value also in cold or rainy weather; and with the large transom seat in addition to a regulation berth, the pilot house serves a number of purposes. Another feature which is quite unusual on so small a boat is the athwartships stateroom. Generous beam (12 feet) makes this possible. Beam is a great factor toward comfort, but is one too often disregarded when planning a real cruiser. Such a craft as this should make a very serviceable party-boat; for as it is a one-man outfit, which could be operated economically, a fellow should be able to make a very fair living in normal times by chartering it out to vacationists.

UNE

GRAY MOTORS

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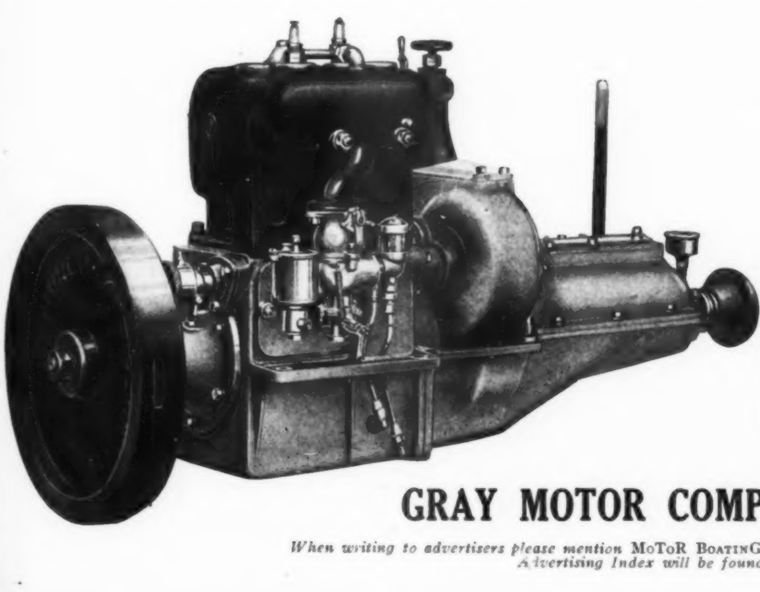

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Helpful Hints for the Motor Boatman

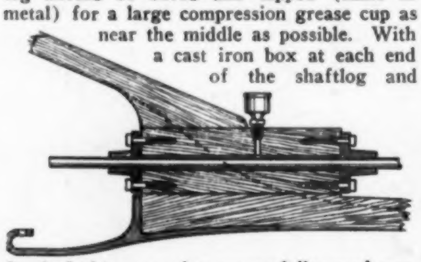
Some of the Devices that Solved the Other Fellows Difficulties

It is MOTOR BOATING'S purpose to publish every month under this heading such methods and kinks as motor boatmen have found helpful to them in their enjoyment of the best of all sports. The subjects will not be restricted to any particular phase of boating but will be as varied as we, with the help of our readers, can make them. To help make this page a success we want our readers to send us short accounts of the little things that have helped them out of their difficulties or stopped the little annoyances that seem bound to occur every so often.—EDITOR.

A Substitute for Bronze Shafting

When owners of small motor boats find that their bronze shaft is so badly worn or bent at the stuffing box that it is beyond repair, the following scheme may be resorted to when bronze shafting cannot be secured or the price is prohibitive.

Have a steel shaft cut and fitted to replace the bronze one and have two cast iron boxes made at a foundry. These should be bored for a running fit to the steel shaft. The shaftlog should be bored and tapped (same as metal) for a large compression grease cup as near the middle as possible. With a cast iron box at each end of the shaftlog and



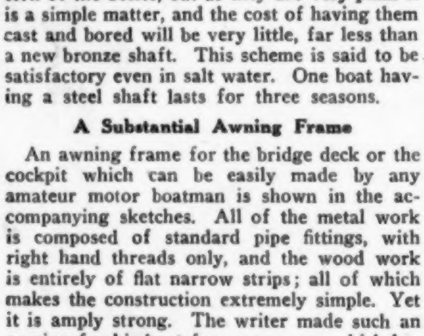
Steel shafting can be successfully used provided the bearings are cast iron and plenty of lubricant is used

the space about the shaft filled with grease from the compression cup, the steel shaft is protected from corrosion and at the same time is lubricated where it passes through the boxes. The shaft log full of grease makes a most satisfactory water-tight stuffing box.

It will be necessary to make a wooden pattern of the boxes, but as they are very plain it is a simple matter, and the cost of having them cast and bored will be very little, far less than a new bronze shaft. This scheme is said to be satisfactory even in salt water. One boat having a steel shaft lasts for three seasons.

A Substantial Awning Frame

An awning frame for the bridge deck or the cockpit which can be easily made by any amateur motor boatman is shown in the accompanying sketches. All of the metal work is composed of standard pipe fittings, with right hand threads only, and the wood work is entirely of flat narrow strips; all of which makes the construction extremely simple. Yet it is amply strong. The writer made such an awning for his boat four years ago, which has withstood the storms and gales of all these years without a sign of failure. It has a spread 12 feet wide and 16 feet long, and the parts are of the dimensions shown herewith. The upright stanchions *A* are of ½-inch iron pipe. At the top of each stanchion is screwed a cross, *B*, which is of ½-inch pipe size in its vertical run, and of ¾-inch pipe size in its horizontal run. Into the upper ends of these crosses are screwed ½x2-inch nipples, *C*, and onto the top of each nipple is screwed a four-lug floor flange, *D*. The length of the nipples, *C*, is a matter of choice, however, so long as they are all the same. Through the horizontal openings of the crosses, *B*, is slipped the long ½-inch pipe, *E*, on the ends of which are screwed the ½-inch elbows, *F*, which also have ½-inch nipples, *C*, in their upper ends, flanges, *D*, being screwed to these nipples, *C*,



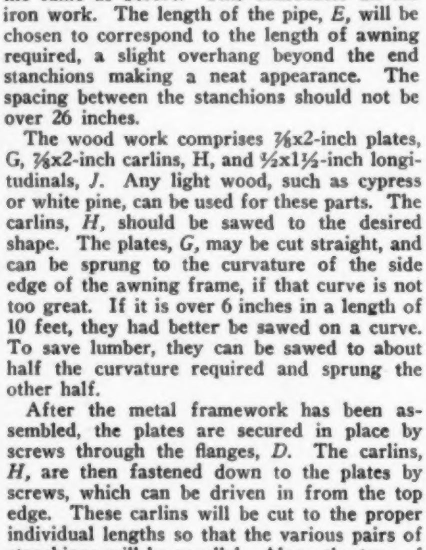
Composite awning frame using pipe and fittings for the straight work and wooden carlins

the same as before. This constitutes all the iron work. The length of the pipe, *E*, will be chosen to correspond to the length of awning required, a slight overhang beyond the end stanchions making a neat appearance. The spacing between the stanchions should not be over 26 inches.

The wood work comprises ⅞x2-inch plates, G, ⅞x2-inch carlins, H, and ½x1½-inch longitudinals, *J*. Any light wood, such as cypress or white pine, can be used for these parts. The carlins, *H*, should be sawed to the desired shape. The plates, *G*, may be cut straight, and can be sprung to the curvature of the side edge of the awning frame, if that curve is not too great. If it is over 6 inches in a length of 10 feet, they had better be sawed on a curve. To save lumber, they can be sawed to about half the curvature required and sprung the other half.

After the metal framework has been assembled, the plates are secured in place by screws through the flanges, *D*. The carlins, *H*, are then fastened down to the plates by screws, which can be driven in from the top edge. These carlins will be cut to the proper individual lengths so that the various pairs of stanchions will be parallel. Along the tops of the carlins are fastened the light longitudinals, *J*, which form the support for the awning cover. These are preferably screwed to each carlin.

The awning cover should be made of such size as to fall about 3 inches short of each end carlin, and to extend over the sides down as far as the plates, *G*. Then the cover can be laced to the pipes, *E*, and to the two end carlins.



Water and sediment in the gasoline tank can be kept out of the piping by collecting it in a trap from which it can be drawn at intervals

Dirt and Water Trap for Gasoline Tank

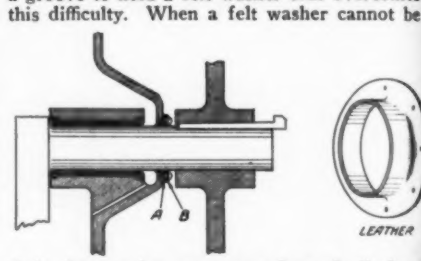
The trap is a box made of copper or galvanized iron (same as tank) and soldered to the bottom of the tank after first cutting a hole the same size as the trap. It should be at least 2 inches in diameter and of about the same depth. The bottom should be cut from ⅛-inch sheet brass and tapped for gasoline line and drain.

When threaded pipe is used the nipple should be screwed into the trap before soldering to the tank. If copper tubing is used the threaded end of the shut-off can be drilled out for a depth of about ¼-inch and a piece of tubing soldered into it. This scheme has the minimum number of joints in the line, and the least chance of leakage.

All water and sediment in the gasoline will settle to the lowest part of the tank (in this case the trap)—and should be drained off at intervals of a month or so. As the gasoline is drawn through the vertical tube some distance above the bottom it will be free of dirt and water, yet the entire contents of the tank are available for use in the motor. The usual strainer is not necessary.

Leather Washers Stop Oil Leakage from Crankcase

It frequently happens that the oil in the crankcase leaks out along the shaft through the end bearings. Some motors are built with a groove to hold a felt washer that overcomes this difficulty. When a felt washer cannot be



A leather washer to prevent loss of oil along the crankshaft

used the same result can often be obtained by making a cup washer out of leather, and slipping it over the ends of the shaft.

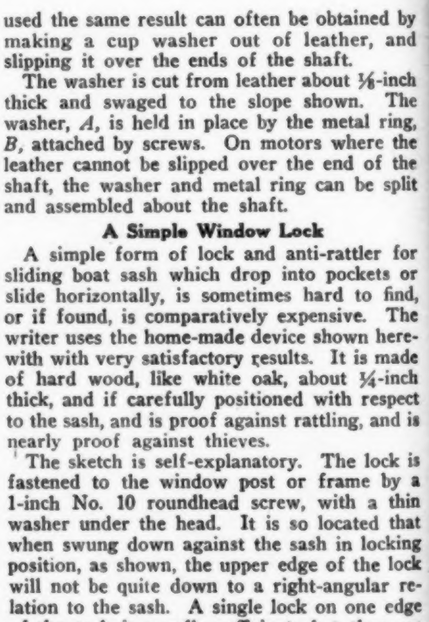
The washer is cut from leather about ⅛-inch thick and swaged to the slope shown. The washer, *A*, is held in place by the metal ring, *B*, attached by screws. On motors where the leather cannot be slipped over the end of the shaft, the washer and metal ring can be split and assembled about the shaft.

A Simple Window Lock

A simple form of lock and anti-rattler for sliding boat sash which drop into pockets or slide horizontally, is sometimes hard to find, or if found, is comparatively expensive. The writer uses the home-made device shown herewith with very satisfactory results. It is made of hard wood, like white oak, about ¼-inch thick, and if carefully positioned with respect to the sash, and is proof against rattling, and is nearly proof against thieves.

The sketch is self-explanatory. The lock is fastened to the window post or frame by a 1-inch No. 10 roundhead screw, with a thin washer under the head. It is so located that when swung down against the sash in locking position, as shown, the upper edge of the lock will not be quite down to a right-angular relation to the sash. A single lock on one edge of the sash is usually sufficient; but they are so inexpensive and easy to make that one on each edge of the sash may be used.

The little wire pin, suspended by a small chain from a screw-eye, and inserted in a hole in the window post above the locking piece, is not essential for tightness of the sash; but it will prevent the sash from being opened from the outside by mere upward pressure.



Drop sash can be kept from rattling by this cam-shaped latch

Creating Life Artificially

(*Continued from page 60*)

In short, the old differentiation between living and non-living is still said to hold good.

Living beings are built up of cells; which multiply by division, and depend upon nutrition for growth, and until these cells have been duplicated in their actions, their development and method of reproduction, it is premature to speak of the artificial duplication of life phenomena.

Now, however, we come to the most striking experiments of all, in which Dr. Le Duc succeeded, apparently in duplicating, almost exactly, the precise details of cell-division, known as karyokinesis, which have always been considered examples, par excellence, of life or vital phenomena. Yet they have been duplicated by means of osmotic pressure, in great detail, and with striking similitude.

When a cell divides, and multiplies into two cells, the process is somewhat as follows. In the center of each cell is the nucleus. This is full of thread-like material known as chromatin. To one side of the nucleus is a tiny polar body, known as a centrosome, which seems to send out lines of invisible force, like a magnet. Now, this centrosome divides into two; these two move round until they are on opposite sides of the nucleus. Meanwhile, the thread-like chromatin has bunched itself together into more solid and less numerous bodies known as chromosomes. These latter range themselves in two straight rows—apparently under the attractive influence of the centrosomes. They split across their centers, and are drawn to the centrosomes. When nearly there, the cell divides across the middle, and two new independent cells are formed—this process being kept up, apparently, forever, or so long as life and growth are maintained.

Now, this whole process is very strikingly duplicated experimentally by means of diffusion (see Figure 7). Here we see the central, nucleus-like body, composed apparently of thread-like chromatin, and the two star-like centrosomes. These latter seem to exert an attractive force upon the central mass; the threads begin to divide in the center, and a complete division is effected in photograph C. Then, finally, we have two cells in juxtaposition, each with its nucleus, its protoplasm, and its enveloping membrane.

Here, surely, we have a very close approximation to life phenomena in its most detailed and intimate form. Indeed, we might perhaps legitimately go further, and say with Dr. Le Duc: "Without attaching to it an importance which is not warranted by experimental results, it is interesting to note that we have here two methods of fertilization—by centrosomes of greater concentration and by those of lesser concentration than that of the plasma of the ovum, and that we have in nature two corresponding results, *viz.*: two different sexes. It is possible that we have in these two methods of producing nuclear divisions the secret of the difference of sex."

At all events, it has been shown that these osmotic growths imitate very closely the process of life, of the organic world, and open a new chapter in the experimental demonstration of similar mechanisms or modes of life. As Dr. Le Duc concludes his remarkable monograph in the following recapitulation, we cannot do better than do likewise, thus summarizing the close resemblances between living beings and these osmotic growths, and bringing before us vividly the significant fact that life, or rather living things, may perhaps after all one day be artificially created. He says:

"Let us briefly recapitulate. An osmotic growth has an evolutionary existence; it is nourished by osmosis and intussusception (slipping of one part into another); it exercises a selective choice on the substances offered to it; it changes the chemical constitution of its nutriment before assimilating it. Like a living thing, it ejects into its environment the waste-products of its function. Moreover, it grows and develops structures like those of living organisms, and it is sensitive to many exterior changes.

Advertising Index will be found on page 96

Frisbie an' I

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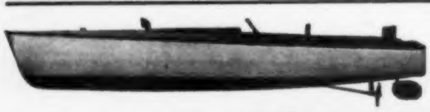

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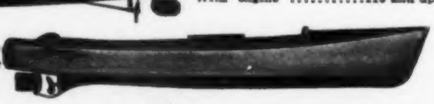

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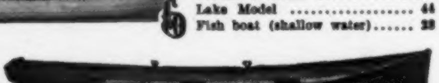

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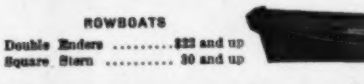

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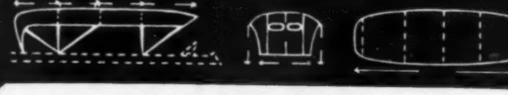

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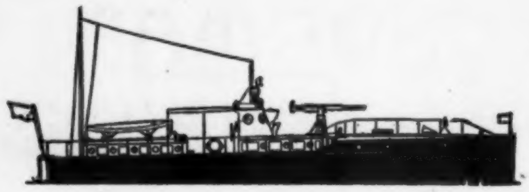

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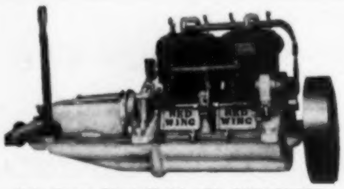

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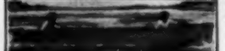

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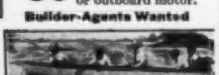

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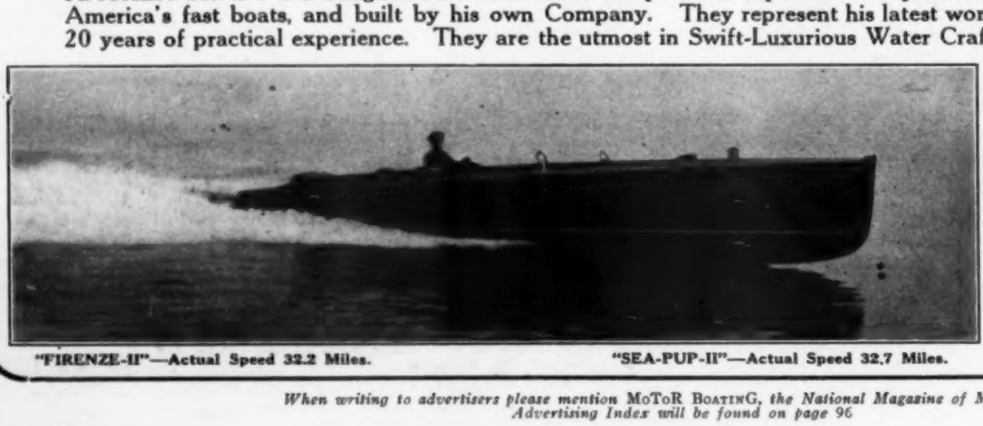

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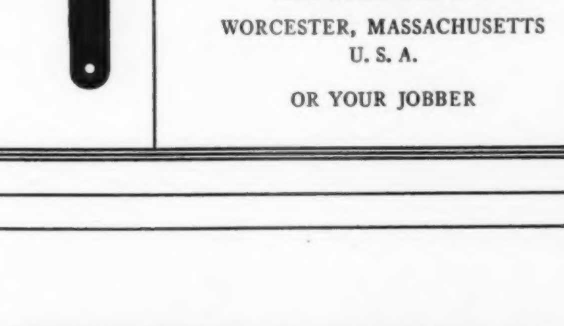

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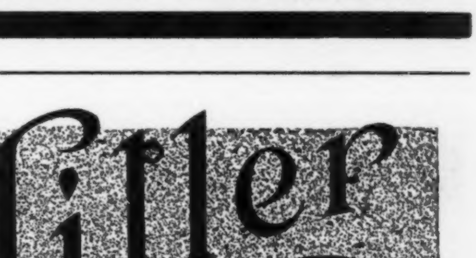

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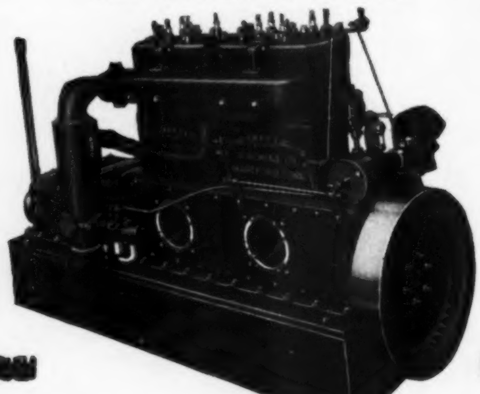

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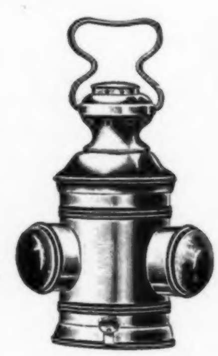

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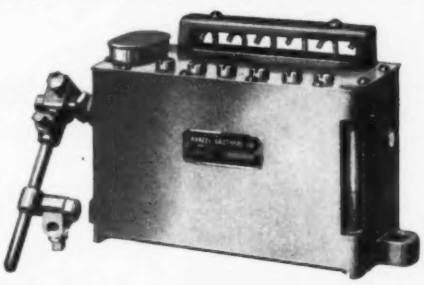

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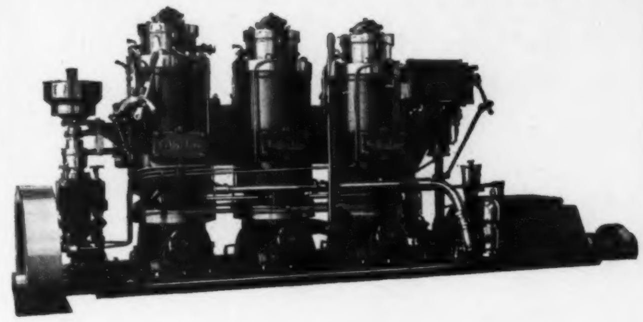

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Operates on any of the crude fuel oils or kerosene.

Absolutely reliable. Fuel consumption .55 lbs per H.P. hours.

SIZES 60 H.P. UPWARDS

KAHLENBERG standard engines in medium and heavy duty types are made in sizes from 2 to 54 H.P. and we would strongly recommend them for operating on KEROSENE, SOLAR OIL and GAS OIL. You ought to know more of the exclusive advantages the KAHLENBERG offers you.

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There's one successful way to get it—install an Olsen Vaporizer. Easily and quickly attached to any 1 to 3 inch carburetor. It gives your motor increased flexibility, the same power as gasoline and nets you a saving of from 50 to 60 cents on every dollar's worth of fuel. The Olsen burns clear kerosene down to the last drop and is equally efficient on low, high or medium speed motors. It has taken the place of so-called kerosene burners as factory equipment among several makes of marine motors.

If you expect to install a new motor this spring insist that the manufacturer supply your motor with an Olsen. If you plan to use your old motor you easily transform it into a kerosene burner by attaching an Olsen yourself.

Read what the Olsen did in the Grenfell Trip to Labrador. Our booklet gives this and other interesting experiences. May we send you one?

Full Cost Refunded in 30 Days on Request

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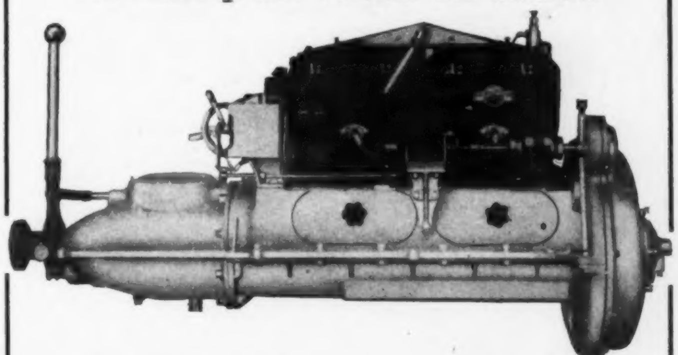


Distillate, Kerosene, Gasoline

The SCRIPPS line is unusually complete. It includes power plants for every marine purpose, of every size and type from 10 to 125 H.P.—all four cycle engines in two, four or six cylinders, medium duty or high speed—some using gasoline exclusively, others fitted for burning either gasoline or kerosene.

Catalogs on request.

SCRIPPS MOTOR COMPANY
631 Lincoln Avenue, Detroit, Michigan, U. S. A.

America's Standard Four-Cycle Engine

KERMATH

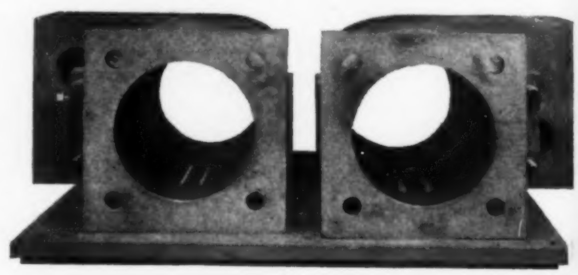
Where Quantity Production—cuts the costs and keeps up the "Kermath" high quality

America's Standard Four-Cycle Engine

KERMATH

KERMATHS IN THE MAKING—PARTIAL VIEWS OF FACTORY

Advertising Index will be found on page 96



Advertising Index will be found on page 96

Sonora models are notable not only for excellence of workmanship, beauty of appearance, and magnificence of tone, but for the wide variety of designs which the buyer can choose from.

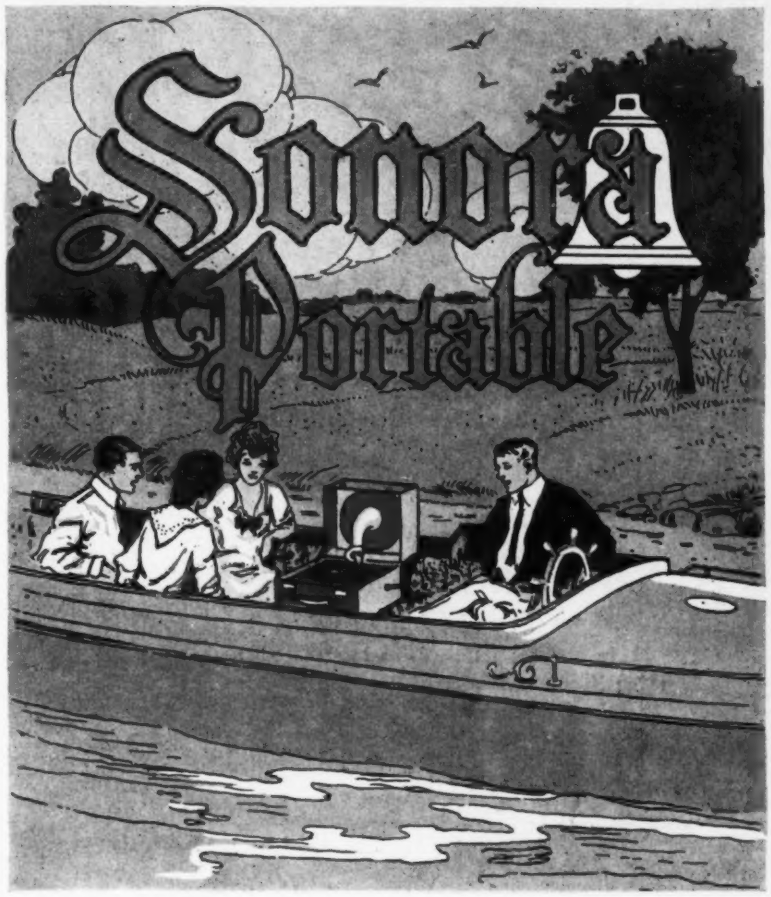
Because so many wealthy business and professional men and women have purchased Sonoras, some people may believe that the Sonora is too expensive for the modest purse. This is not true because the Sonora can be obtained from $50 up.

It is often desired to have this phonograph match the furnishings of a certain room.

At the Fifth Avenue Salon of the Sonora, magnificent Period designs are now on view. These include Gothic, Chippendale, Chinese Chippendale, Louis XV, Louis XVI, Jacobean, Queen Anne, Adam, Colonial and Duncan Phyfe.

Information regarding these or standard models will be furnished gladly. When writing it is requested that you mention the period style in which you are interested.

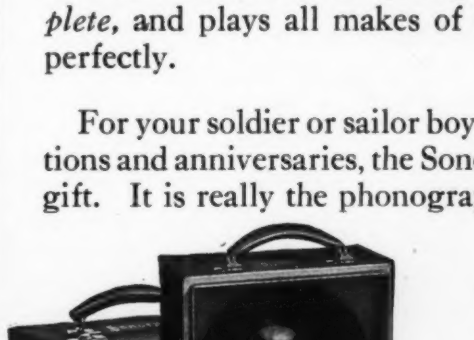
It should be remembered that at the Panama Pacific Exposition Sonora won highest score for tone quality and is now recognized as "The Highest Class Talking Machine in the World."



ABOARD the cruiser, when motoring, when at the beach or in the mountains, a good phonograph is a delight, but here the large cabinet model is an impossibility.

The Sonora Portable fills this need for a light, easily-transported *quality* phonograph. It has the wonderful rich true Sonora tone, *weighs only* 15 *pounds complete,* and plays all makes of disc records, all sizes, perfectly.

For your soldier or sailor boy, for weddings, graduations and anniversaries, the Sonora Portable is the ideal gift. It is really the phonograph of a thousand uses.



Price $60

Today write for catalog

Sonora Phonograph Sales Company, Inc.

George E. Brightson, President
279 Broadway,
New York

Building a War-Time Knockabout

(*Continued from page* 43)

convenient place to store the anchor, rope and other gear. A slatted floor in this space made by fastening strips across from one bilge stringer to the other will be a great convenience in keeping the contents out of the bilge water.

The floor is carried on ⅞x2½-inch beams which in turn rest on the bilge stringers as shown in Fig. 1 and Fig. 2. The flooring should be ⅞x3-inch white pine dressed and edged but not matched. This should be laid with a space between the boards to prevent buckling when wet. The three middle boards should be nailed to cleats so that they are removable for pumping out the bilge, recovering lost articles, etc.

The Rudder

The rudder is to be made of 1⅛-inch oak, the two pieces being held together by 5/16-inch galvanized iron rods as shown in Fig. 1. After the pieces have been fastened together, the rudder is planed to a taper so that the after edge is only ⅞-inch thick and the forward part brought to quite a sharp edge where it is cut away for the wheel. It is to be hung onto the transom by regular rudder gudgeons with long straps and also to the skeg in the same manner. The two upper gudgeons should be of the double eye type with a galvanized rod run through both. The lower eye on the transom being above the eye on the rudder, and the upper eye on the transom being below the eye on the rudder.

The tiller is made of galvanized strap iron ⅛x1⅛ inches bent around the rudder and riveted together at least at three places inside the boat and fastened to the rudder by two bolts through the whole thing. Bore two holes through the inner end for the tiller rope about 18 inches from the edge of the rudder. Blocks should be nailed to the deck beam so that the tiller cannot turn more than 50 degrees either side of the center.

The Fuel Tank

When it comes to purchasing the fuel tank, get the best one you can afford. The galvanized seamless steel kind generally give the best satisfaction. The tank shown in Fig. 1 is 14x24 inches, holding sixteen gallons and will be amply big for a 5 h.p. motor. It is held to the deck by two galvanized iron straps and sets in chocks on the chines as shown in Fig. 2.

The filler pipe should be provided with a brass deck-plate of the type that screws fast to the pipe. This prevents spilled gasoline getting into the boat when filling the tank. The pipe to the motor should be 5/16 or better yet ⅜-inch O.D. copper tubing, run along one side preferably on top of the chine. Don't run it in the bilge—it's dangerous. Use a good gasoline cock or a globe with a ground union right next the tank and another at the carbureter. Have no joints in the gasoline line between these two fittings, and solder the tube fast to the union. Flanged or compression couplings are all right—but they have been known to work loose. In making turns always bend the tubing to a large radius, and don't figure the length so closely that you almost have to stretch the tubing to make it meet at the ends. Have some slack to spare. You cannot be too careful about this part of the work. Remember that the majority of boats lost by fire can trace the cause to a leak somewhere between the tank and the engine.

Hardware and Fittings

Use large diameter galvanized sheaves for the tiller rope at the corners of the transom and also at the forward bulkhead. The ordinary galvanized pulley will cut the rope in an amazingly short time. Use fairleaders along the sides to hold the rope in near the planking.

The steering wheel can be either of galvanized iron or brass, but if the latter, be sure it is heavy. Some are too thin and too small to be of much service. The chocks should be at least large enough to hold a ⅞-inch rope without binding or jamming and the 9-inch cleat will be none too big. If you use a padlock on the engine compartment be sure it is all brass—inside as well as outside—otherwise it may rust shut and have to be cut off. A Yale padlock costs more but is worth it.

Caulking, Finishing and Painting

The caulking and finishing should be done after all the carpenter work is complete. For a boat this size the most satisfactory material for the seams is caulking cotton. This comes in loosely rolled strands ready for use. Use only a caulking iron with a very narrow edge and do not drive the cotton in too tight, and use a small wooden mallet, not a hammer.

As one strand of the caulking cotton is not enough to fill the seams, it is customary to drive it in as a series of loops. Start at one end of a seam and drive in about 1-inch of the end of a strand, then loop the cotton back and drive in the loop and about 1-inch more, loop it back again about 1-inch and drive it in, the second loop should just overlap the first loop. Continue with this method of looping and driving until you reach the end of the seam. By varying the size of the loops to suit the width of the seam it is possible to have a uniform pressure throughout the length of the seam. The seam along the keel chine, rabbet, and transom should be caulked very carefully so as not to start the fastenings.

When finished caulking the cotton should be about ⅛-inch below the surface. Now take a sharp plane and smooth up the seams and the whole outside of the hull. Do this carefully as any unevenness will always show more plainly after painting and it is then too late to correct it. Follow up the planing with fine sandpaper.

After the hull has been smoothed up and given the priming coat of paint, putty the seams with either an elastic seam composition or a

(*Continued on page* 88)

Motor Boats Hunt the Huns

(*Continued from page* 56)

vented by bombing from airplanes and shelling from Flanders and the sea.

The American built motor boats that proved such a success in the raids on Zeebrugge and Ostend were the once despied but now thoroughly appreciated ML's, the 80-footers built by the Elco Co., of Bayonne, N. J. The same boats on which all previous construction records were broken. Five hundred and fifty of these boats were built and delivered to the British government ready for use in less than 500 days.

The first few of these boats were completed at Bayonne, N. J., and run to Canada under their own power, then came the cold weather and ice, closing navigation. An attempt was made to ship them by rail, but after eighty-four had been delivered in this manner, it was decided to get out all the parts—every piece entering into the construction—of these boats at the Bayonne plant, fit them, ship them to Canada, and assemble them at yards near Quebec and Montreal.

These chasers are of the raised-deck type, 80 feet long and powered with two six-cylinder 220 h.p. Standard motors. The interior layout provides a chain locker in the forepeak with the crew's quarters immediately aft. The engine-room and galley are located amidship, with the officers stateroom aft.

On deck, a gun is mounted forward just behind the breakwater. The chart house and navigation bridge are just ahead of the break of the raised deck. The after cabin trunk is built so that the roof is level with the raised deck forward.

Without such motor boats as these, capable of a speed of over 19 knots, and able to maneuver rapidly—so fast, in fact, that it is all but impossible to get the range and then hit them with a large size gun, it is doubtful whether such raids as those on Zeebrugge and Ostend could be carried out with success.

Surely the loss of life would have been much greater had they not had these fast motor boats to take the men off the block ships, place the flares, spread the smoke screen and successfully perform the other difficult tasks right under the enemies' guns. It was the speed and maneuvering ability that counted.

The Air Pilot's Story

(*Continued from page* 56)

feels just the same as before, and only observation of the surface will tell me I am not going where I am looking!"

"You can't get much out of observation of the surface of the water!" objected the commodore.

"Not much—but a little," was the smiling reply. "I can fly low enough over water to see the waves and give a guess as to the distances between them. The direction of waves (I am speaking now of waves off shore) is normally at right angles to wind direction. And the distance of wave tops apart is an unreliable but better-than-none-at-all indication of wind velocity."

"Well, why is it necessary to know the wind velocity? Except in cases of extreme winds, your speed is so much greater that I should think you could ignore it." Speed Maniac was still thinking in terms of gas boats.

"So we might, if it wasn't for the fact that we have a limiting factor called radius of action," answered the pilot. "We don't carry gas enough for an unlimited cruise. Of course the gas capacity differs largely with the machine. This thing I'm flying in now has had all kinds of power plants put into it just to see—oh, various things! I mustn't particularize too much or Congress will investigate me and George Creel sit on me! But at present I've a three-hour capacity tank. Calling my speed 75 miles an hour, that means a radius of action of 225 miles. I can go 112 miles out to sea and turn around and come back again. But if I go 120 miles out to sea the only way I'll get back is via a boat!

"This calculation is simple enough—in a calm. But suppose there is an ocean breeze coming in at 40 miles an hour. Obviously, I go out to sea at 75 miles an hour minus the forty the wind is robbing me of—35 miles per hour. And on the return trip I skedaddle home at my speed plus wind speed, or 115 m.p.h. In other words, I come back"—the pilot pulled an envelope and pencil from his pocket and figured an instant—"I come back 3.29 times as fast as I go out. But I want to know how far out I can go and still get back. So I say that the time on the out journey is X and the time on the return journey is X multiplied by 3.29. The sum of the two is equal to the total time—180 minutes—before my fuel is used up. It doesn't take much figuring to prove I can spend 138 minutes going out because I can get home in 42 minutes. My mileage, of course, is 35 miles an hour going or a total of 80.5, and the same returning. And if I don't know the wind velocity or make proper allowances for it, or if it increases largely as I go out, I'm going to land in the water! What? Of course this is theory—no one works on so close a margin, or takes long water trips except in a sea plane or flying boat. But you asked about importance of wind velocity!"

"Well!" The commodore rose and beckoned once more to the white coat. "I know a lot more than I did. And all I can say is that—I'm glad I'm way beyond the age when they draft air pilots! I think I'll stick to two dimensional navigation, thank you!"

"No, you won't!" The pilot smiled, robbing his direct contradiction of any offense. "It's a big thing now—a new thing—a strange thing. But in a few years—maybe less than twenty—flying a plane and running a motor boat, navigating the air and going yachting, will be one and the same thing as far as difficulty or danger or their lack is concerned."

"May I be there to see!" said Wheels. "Here's to the pilot!"

And they drank it standing.

All France Wonders at American Engineers

(*Continued from page 24*)

ing the recent retreat in Flanders the trains carrying both men and supplies were repeatedly under heavy fire. The Germans' advance one day drove the British from a position, obliging them to abandon a supply of shells valued at $200,000. A murderous fire prevented the men from regaining the position. Part of the supplies had already been set on fire, when a daring railroad engineer backed his train through the barrage and sat calmly, hand on throttle, while soldiers put out the fire and loaded the shells on the train. Although the train and locomotive were repeatedly struck the engineer finally brought his train safely to the protection of the British lines.

The fighting qualities of the American engineers at Cambrai are famous. According to the official British report, a force of American railroad men were working in what was supposed to be a safe position when the Germans suddenly advanced on them, firing as they came. The Americans dropped their tools and seized guns. To quote the British officer's own words, "They held on by their teeth until the last moment, inflicting terrible losses on the enemy, when they moved back, waited for the Germans and repeated the operation."

According to the Director General of Military Railroads orders were placed during the first year of the war for 754,000 tons of railroad materials, valued at $142,000,000. This is only a detail, however, of the great enterprise conducted by American railroad men in France.

Building A War-Time Knockabout

(*Continued from page 84*)

mixture of white lead and whiting about the consistency of putty, also fill all the nail and screw holes at the same time.

Before puttying, the sides above the waterline should be given a priming coat of paint diluted with plenty of linseed oil. Finish with three coats of good marine paint. The bottom (below the waterline) should be given two coats of anti-fouling copper bottom paint, the first coat to be applied directly to the wood. This paint will peel off if there is any lead and oil paint on the wood, or any putty along the edges of the seams, have the wood perfectly clean.

The coaming, bulkheads and all interior woodwork should be carefully sandpapered and given a coat of filler. Follow this with three coats of good spar varnish, going over each coat lightly with fine sandpaper before applying the next coat.

The canvassed decks should be given two thin coats of paint. Do not use too much paint on the canvas as it will crack and peel off. If it appears rough after the first coat has dried hard, go over it lightly with fine sandpaper. For the first season the weave of the canvas should show through the paint, but the painting the second season should give a smooth finish.

Nothing will be said here in regard to the installation of the motor, as it will vary somewhat with each make and the manufacturers furnish full directions. Just one word about the ignition system. Stranded ignition wire is covered with better insulation for this service than ordinary electric light wire, it is oil- and water-proof. Keep all wires well up near the deck. Under no consideration run wires under the floor in the bilge. These simple hints will save you from many ignition difficulties.

What Constitutes A Comfortable Cruiser

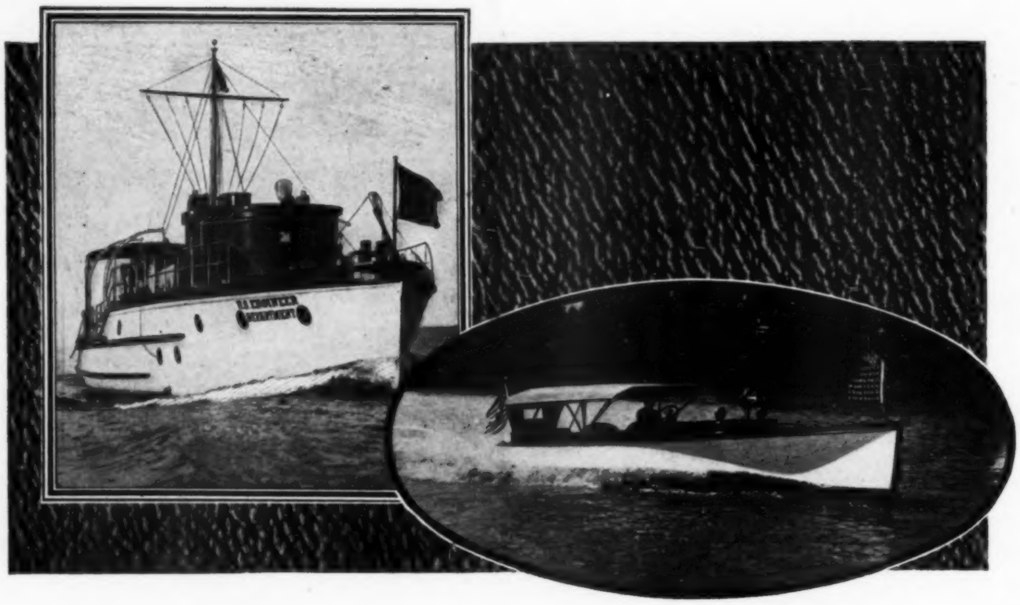
(*Continued from page 44*)

ally asserts itself and results, sometimes, in a young mutiny. Little annoyances and inconveniences, quite minor in themselves, occasionally become exaggerated, thereby creating friction; and thus proving the soundness of the expression about familiarity breeding contempt. The novelty of roughing it soon wears off, but the desire for comfort is ever present. Therefore, where the size of the boat will permit, segregate the crew and everyone will be happier.

A well-equipped galley is, of course, essential to comfort, but there are two or three other angles from which it should be viewed. To provide meals for a ravenous crew is no small task; so make things as easy for the cook as possible by having the stove, ice-box, sink, etc., of full capacity. The location of the galley is of importance.

To be able to stretch ones legs by taking an occasional turn about deck is not only a source of comfort but a luxury as well. On the majority of small boats, especially of the cockpit variety, there is little room to walk about. We have here, however, a boat where one may take his constitutional in perfect ease. The forward deck, even, provides comfort in this respect, for a railing is provided that is of some real service.

This little vessel should give a good account of herself in rough water. Under such conditions comfort again is provided by means of the pilot house. This is of value also in cold or rainy weather; and with the large transom seat in addition to a regulation berth, the pilot house serves a number of purposes. Another feature which is quite unusual on so small a boat is the athwartships stateroom. Generous beam (12 feet) makes this possible. Beam is a great factor toward comfort, but is one too often disregarded when planning a real cruiser. Such a craft as this should make a very serviceable party-boat; for as it is a one-man outfit, which could be operated economically, a fellow should be able to make a very fair living in normal times by chartering it out to vacationists.



Helpful Hints for the Motor Boatman

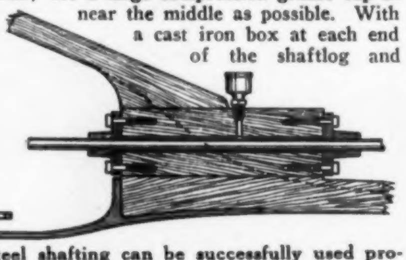
Some of the Devices that Solved the Other Fellows Difficulties

It is Motor Boating's purpose to publish every month under this heading such methods and kinks as motor boatmen have found helpful to them in their enjoyment of the best of all sports. The subjects will not be restricted to any particular phase of boating but will be as varied as we, with the help of our readers, can make them. To help make this page a success we want our readers to send us short accounts of the little things that have helped them out of their difficulties or stopped the little annoyances that seem bound to occur every so often.—Editor.

A Substitute for Bronze Shafting

When owners of small motor boats find that their bronze shaft is so badly worn or bent at the stuffing box that it is beyond repair, the following scheme may be resorted to when bronze shafting cannot be secured or the price is prohibitive.

Have a steel shaft cut and fitted to replace the bronze one and have two cast iron boxes made at a foundry. These should be bored for a running fit to the steel shaft. The shaftlog should be bored and tapped (same as metal) for a large compression grease cup as near the middle as possible. With a cast iron box at each end of the shaftlog and



Steel shafting can be successfully used provided the bearings are cast iron and plenty of lubricant is used

the space about the shaft filled with grease from the compression cup, the steel shaft is protected from corrosion and at the same time is lubricated where it passes through the boxes. The shaft log full of grease makes a most satisfactory water-tight stuffing box.

It will be necessary to make a wooden pattern of the boxes, but as they are very plain it is a simple matter, and the cost of having them cast and bored will be very little, far less than a new bronze shaft. This scheme is said to be satisfactory even in salt water. One boat having a steel shaft lasts for three seasons.

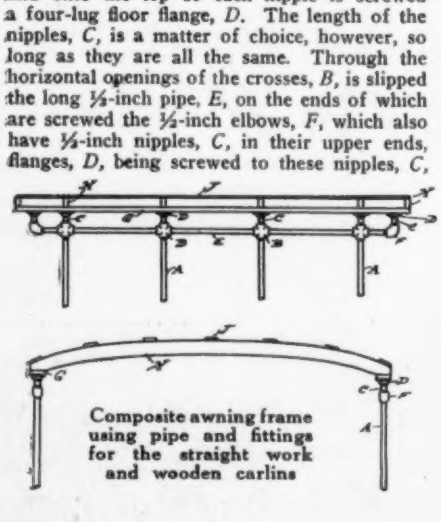
A Substantial Awning Frame

An awning frame for the bridge deck or the cockpit which can be easily made by any amateur motor boatman is shown in the accompanying sketches. All of the metal work is composed of standard pipe fittings, with right hand threads only, and the wood work is entirely of flat narrow strips; all of which makes the construction extremely simple. Yet it is amply strong. The writer made such an awning for his boat four years ago, which has withstood the storms and gales of all these years without a sign of failure. It has a spread 12 feet wide and 16 feet long, and the parts are of the dimensions shown herewith. The upright stanchions *A* are of ½-inch iron pipe. At the top of each stanchion is screwed a cross, *B*, which is of ½-inch pipe size in its vertical run, and of ¾-inch pipe size in its horizontal run. Into the upper ends of these crosses are screwed ½x2-inch nipples, *C*, and onto the top of each nipple is screwed a four-lug floor flange, *D*. The length of the nipples, *C*, is a matter of choice, however, so long as they are all the same. Through the horizontal openings of the crosses, *B*, is slipped the long ½-inch pipe, *E*, on the ends of which are screwed the ½-inch elbows, *F*, which also have ½-inch nipples, *C*, in their upper ends, flanges, *D*, being screwed to these nipples, *C*, the same as before. This constitutes all the iron work. The length of the pipe, *E*, will be chosen to correspond to the length of awning required, a slight overhang beyond the end stanchions making a neat appearance. The spacing between the stanchions should not be over 26 inches.

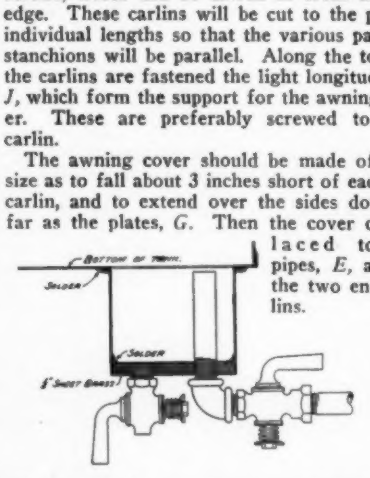
The wood work comprises ⅞x2-inch plates, G, ⅞x2-inch carlins, H, and ½x1½-inch longitudinals, *J*. Any light wood, such as cypress or white pine, can be used for these parts. The carlins, *H*, should be sawed to the desired shape. The plates, *G*, may be cut straight, and can be sprung to the curvature of the side edge of the awning frame, if that curve is not too great. If it is over 6 inches in a length of 10 feet, they had better be sawed on a curve. To save lumber, they can be sawed to about half the curvature required and sprung the other half.

After the metal framework has been assembled, the plates are secured in place by screws through the flanges, *D*. The carlins, *H*, are then fastened down to the plates by screws, which can be driven in from the top edge. These carlins will be cut to the proper individual lengths so that the various pairs of stanchions will be parallel. Along the tops of the carlins are fastened the light longitudinals, *J*, which form the support for the awning cover. These are preferably screwed to each carlin.

The awning cover should be made of such size as to fall about 3 inches short of each end carlin, and to extend over the sides down as far as the plates, *G*. Then the cover can be laced to the pipes, *E*, and to the two end carlins.



Composite awning frame using pipe and fittings for the straight work and wooden carlins



Water and sediment in the gasoline tank can be kept out of the piping by collecting it in a trap from which it can be drawn at intervals

Dirt and Water Trap for Gasoline Tank

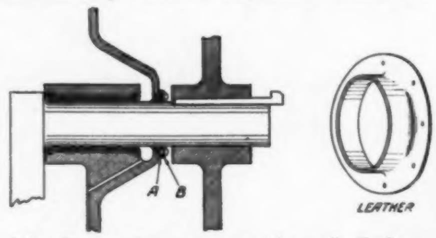
The trap is a box made of copper or galvanized iron (same as tank) and soldered to the bottom of the tank after first cutting a hole the same size as the trap. It should be at least 2 inches in diameter and of about the same depth. The bottom should be cut from ¼-inch sheet brass and tapped for gasoline line and drain.

When threaded pipe is used the nipple should be screwed into the trap before soldering to the tank. If copper tubing is used the threaded end of the shut-off can be drilled out for a depth of about ¼-inch and a piece of tubing soldered into it. This scheme has the minimum number of joints in the line, and the least chance of leakage.

All water and sediment in the gasoline will settle to the lowest part of the tank (in this case the trap)—and should be drained off at intervals of a month or so. As the gasoline is drawn through the vertical tube some distance above the bottom it will be free of dirt and water, yet the entire contents of the tank are available for use in the motor. The usual strainer is not necessary.

Leather Washers Stop Oil Leakage from Crankcase

It frequently happens that the oil in the crankcase leaks out along the shaft through the end bearings. Some motors are built with a groove to hold a felt washer that overcomes this difficulty. When a felt washer cannot be



A leather washer to prevent loss of oil along the crankshaft

used the same result can often be obtained by making a cup washer out of leather, and slipping it over the ends of the shaft.

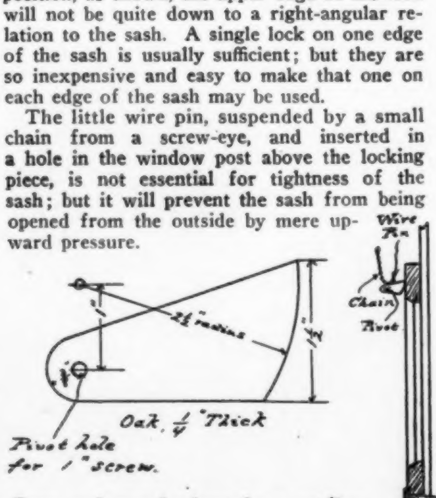
The washer is cut from leather about ⅛-inch thick and swaged to the slope shown. The washer, *A*, is held in place by the metal ring, *B*, attached by screws. On motors where the leather cannot be slipped over the end of the shaft, the washer and metal ring can be split and assembled about the shaft.

A Simple Window Lock

A simple form of lock and anti-rattler for sliding boat sash which drop into pockets or slide horizontally, is sometimes hard to find, or if found, is comparatively expensive. The writer uses the home-made device shown herewith with very satisfactory results. It is made of hard wood, like white oak, about ¼-inch thick, and if carefully positioned with respect to the sash, and is proof against rattling, and is nearly proof against thieves.

The sketch is self-explanatory. The lock is fastened to the window post or frame by a 1-inch No. 10 roundhead screw, with a thin washer under the head. It is so located that when swung down against the sash in locking position, as shown, the upper edge of the lock will not be quite down to a right-angular relation to the sash. A single lock on one edge of the sash is usually sufficient; but they are so inexpensive and easy to make that one on each edge of the sash may be used.

The little wire pin, suspended by a small chain from a screw-eye, and inserted in a hole in the window post above the locking piece, is not essential for tightness of the sash; but it will prevent the sash from being opened from the outside by mere upward pressure.



Drop sash can be kept from rattling by this cam-shaped latch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Skaneateles	on Skaneateles Lake

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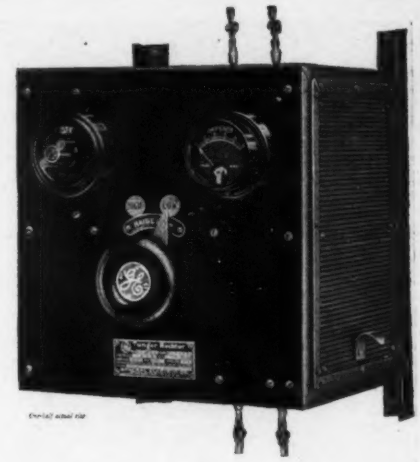

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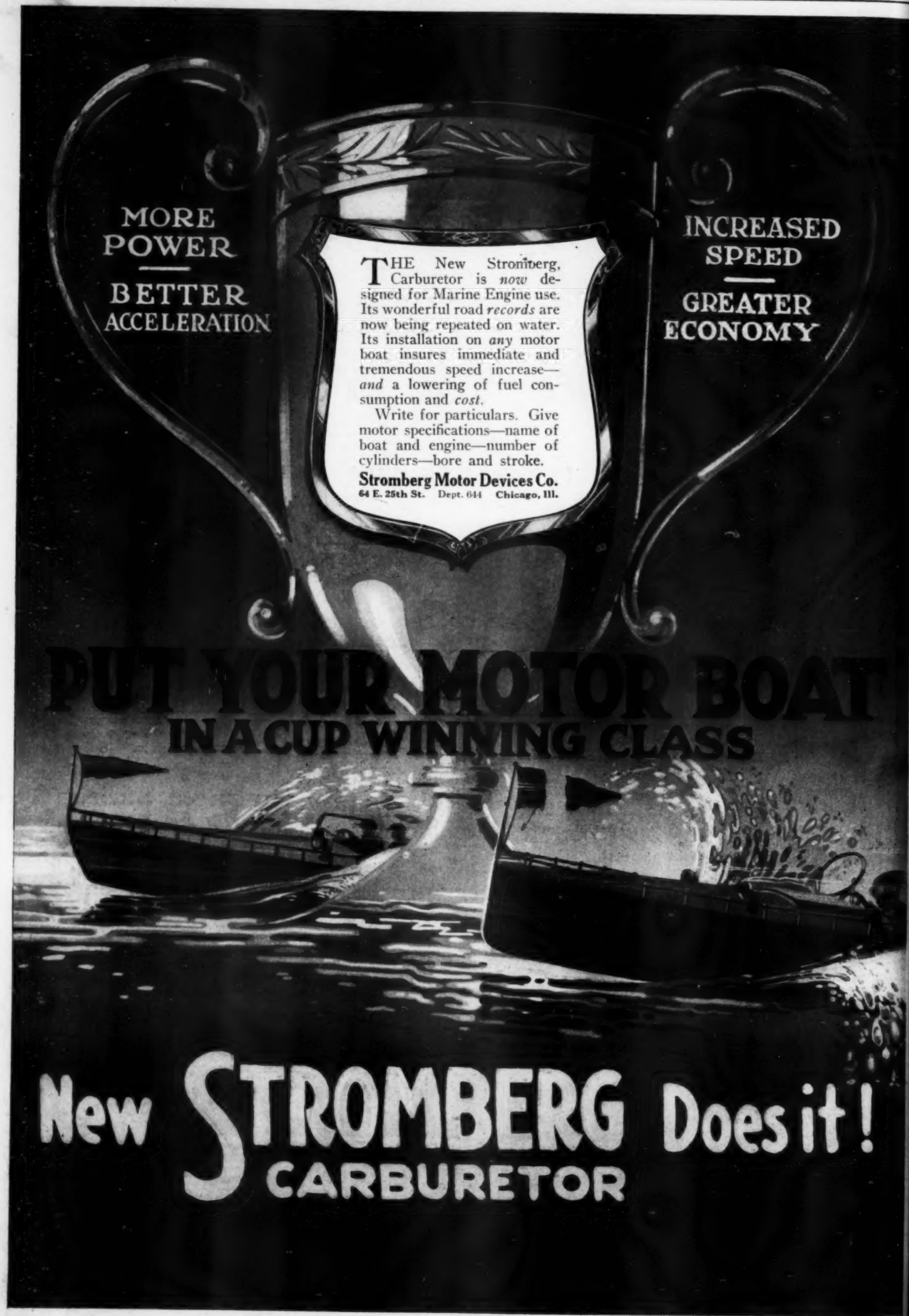
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